



Published in final edited form as:

Am J Prev Med. 2017 July ; 53(1): 78–84. doi:10.1016/j.amepre.2017.01.019.

Children's Moderate to Vigorous Physical Activity Attending Summer Day Camps

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Abstract

Introduction—National physical activity standards call for all children to accumulate 60 minutes/day of moderate to vigorous physical activity (MVPA). The contribution of summer day camps toward meeting this benchmark is largely unknown. The purpose of this study was to provide estimates of children's MVPA during summer day camps.

Methods—Children (N=1,061, 78% enrollment; mean age, 7.8 years; 46% female; 65% African American; 48% normal weight) from 20 summer day camps wore ActiGraph GT3x+ accelerometers on the wrist during camp hours for up to 4 non-consecutive days over the summer of 2015 (July). Accumulated MVPA at the 25th, 50th, and 75th percentile of the distribution was estimated using random-effects quantile regression. All models were estimated separately for boys and girls and controlled for wear time. Minutes of MVPA were dichotomized to ≥60 minutes/day of MVPA or <60 minutes/day to estimate percentage of boys and girls meeting the 60 minutes/day guideline. All data were analyzed in spring 2016.

Results—Across the 20 summer day camps, boys (*n*=569) and girls (*n*=492) accumulated a median of 96 and 82 minutes/day of MVPA, respectively. The percentage of children meeting 60 minutes/day of MVPA was 80% (range, 41%–94%) for boys and 73% (range, 30%–97%) for girls.

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No financial disclosures were reported by the authors of this paper.

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Conclusions—Summer day camps are a setting where a large portion of boys and girls meet daily physical activity guidelines. Public health practitioners should focus efforts on making summer day camps accessible for children in the U.S.

INTRODUCTION

In the U.S., summer day camps (SDCs) are the largest setting outside of the regular school year where children (aged 5–12 years) are presented with opportunities to be physically active. With more than 5,000 SDCs in operation, serving 14 million youth in the U.S. annually,¹ SDCs hold considerable promise as a setting where children can accumulate the recommended 60 minutes/day of moderate to vigorous physical activity (MVPA).² Typically, SDCs last 8–10 hours/day, span the entire summer vacation, and include a wide assortment of activities for children (e.g., enrichment activities, PA opportunities, academic-related activities).³

Although nationally representative objective data indicate that fewer than half of school-age children are meeting PA guidelines,⁴ relatively little is known about PA levels of children attending SDCs. Previous research at SDCs employing objective assessment of children's PA report widely disparate findings (36.9 MVPA minutes⁵ vs 74.8 MVPA minutes⁶). Comparison between studies is limited by the use of different PA measurement devices and small or unrepresentative samples.^{5,6} Children's PA levels during SDCs are unknown. The purpose of this study was to provide accelerometer-derived MVPA estimates in a large sample of children attending SDCs.

METHODS

Study Population

The SDCs operating within a 90-minute drive from the university were invited, through telephone communication, to be part of a larger PA and healthy eating intervention. The main criteria for eligibility consisted of SDCs reporting an enrollment of 50 children the previous year (i.e., summer 2014) and being classified as non-specialized SDCs (i.e., excluding sports camps, residential camps). The data presented herein represents pre-intervention baseline data. In total, 20 SDCs operated by nine organizations in one southeastern state participated in this study. Descriptive characteristics of the 20 SDCs and demographic characteristics of the children attending are presented in Table 1. The mean percentage of household poverty based on SDC ZIP code (factfinder2.census.gov/) was 11.1% (range, 3.8%–27.3%). The SDCs operated an average of 9.4 weeks over the summer (June–August; range, 7.5–10 weeks) and started each day at 9:00AM and operated until around 6:00PM. Each SDC provided a mixture of activities each day (e.g., organized PA games, water-based activities, arts and crafts, reading). All SDCs had access to at least one outdoor green space and more than one indoor play space (e.g., gymnasiums, recreational rooms). Temperature was recorded every data collection day from Weather Underground (www.wunderground.com/) and logged in an Excel file. At the end of data collection, the average daily low and high temperatures were calculated for data collection days. In agreement with the site leaders of the SDCs, all children (excluding children with physical disability) were eligible to participate but could opt out at any time and research assistants

obtained child assent prior to accelerometer placement. All data were collected during the summer of 2015 and all procedures were approved by the University of South Carolina's IRB.

Measures

Children's PA was captured via ActiGraph GT3X+ accelerometers (Shalimar, FL) on a maximum of 4 non-consecutive days (Monday–Thursday) within a 6-week period. The epoch was set at 5-second intervals to account for the transitory PA patterns of children,⁷ and to align with the validation epoch length.^{8,9} Upon arrival at the SDC, an accelerometer was fastened to each child's non-dominant wrist and the arrival time recorded (monitor time on) by trained research assistants. Children participated in the day's normally scheduled activities, and wore the device during water-based activities. Before a child departed from an SDC, a research assistant removed the accelerometer and recorded the time of departure (monitor time off). Validated cut points associated with children's MVPA were used to distill the activity data (>530 counts/5 seconds).⁹ A valid day of accelerometer data was total wear time (time off minus time on) ≥240 minutes.⁵ For the purpose of capturing BMI, children's heights and weights were collected on a separate visit to the SDC and conducted using a portable stadiometer (nearest 0.1 cm) and digital scale (nearest 0.01 pounds). Prior to BMI measurements, children removed their shoes. In addition, children reported their age and school grade, and research assistants classified children as African American, non-Hispanic white, Hispanic, or other. Child-level demographics were recorded on the accelerometer logbook. Additional SDC characteristics were collected by research assistants from the person responsible for the day-to-day operation of the SDC, commonly referred to as the site leader. On each of the 4 measurement days, research assistants obtained copies of the daily/weekly schedule of activities and attendance sheets from the site leader. PA opportunities offered to children were identified from the daily schedules and summed to create a daily total amount of time scheduled for PA for each SDC.

Statistical Analysis

All analyses were conducted using Stata, version 14.1. Participants' demographic characteristics and SDC information were summarized using descriptive statistics. Separate random-effects quantile regression models were run for boys and girls, controlling for time in attendance and modeling the 25th, 50th, and 75th quantile of the distribution with bootstrapped SEs.¹⁰ This approach was chosen owing to the non-normal distribution of the outcome variables. Mixed model logistic regressions, also controlling for time in attendance, were used to examine the odds of achieving the 60 minutes/day MVPA standard for boys and girls, separately. Multivariate analyses were conducted to explore the relationship of weight status (overweight/obese, normal/underweight [ref], BMI missing – $n=184$), race/ethnicity (African American [ref], non-Hispanic white, other), SDC location (school, community center [ref], church, non-traditional locations defined as a strip mall or military base), enrollment size of the SDC (<40 [ref], 40–60, >60 children), and the amount of time scheduled for PA-only opportunities (<2 hours, 2–4 hours, >4 hours), with children's accumulated MVPA. Data analysis took place during spring 2016.

RESULTS

A total of 1,061 children (mean age, 7.9 years; 47% female; 67% African American; 30% normal weight) representing 78% of the total number of children enrolled across the 20 SDCs had 1 valid day of accelerometer wear (Table 1). The average daily low and high temperatures during data collection were 75°F (range, 67–80°F) to 95°F (range, 88–101°F), respectively. Children wore accelerometers for up to 4 days during camp hours (mean, 2.2 days; range, 1–4 days) resulting in a total of 2,437 child days of valid accelerometer data. Median MVPA accumulated by boys and girls was 96 (SD=42) and 82 (SD=33) minutes during the camp day, respectively. Mean percentage of children meeting 60 minutes/day of MVPA was 80% (range, 41%–94%) for boys and 73% (range, 30%–97%) for girls (Table 1).

Boys in the 50th percentile and girls across all percentiles accumulated fewer MVPA minutes (range, –0.3 to 3.4) during the camp day for every 1 year increase in age (Table 2). Further, boys (25th, 50th, and 75th percentiles) and girls (25th and 50th percentiles) missing BMI data accumulated fewer MVPA minutes (range, –9.6 to –17.8) during the camp day compared with normal/underweight girls. In addition, boys and girls classified as “other,” and in the 50th percentile, were less active by at least 11 MVPA minutes during the camp day compared with African American boys and girls (Table 2.) Independent sample *t*-tests (age) and chi-square statistics (sex, race/ethnicity) were conducted among those with BMI data and those missing BMI data, and a significant difference was observed for race/ethnicity ($p>0.05$).

Table 2 presents findings pertaining to specific SDC characteristics and MVPA minutes children accumulated during the camp day. In short, children attending SDCs operating in “non-traditional locations” ($n=3$) were less active (range, –22.4 to –48.2 MVPA minutes during the camp day) than those attending SDCs operating out of community centers ($n=9$). This outcome was similar for children attending SDCs that operated out of schools or faith-based centers. Children attending SDCs that enrolled between 40–60 children/day were more active by 12 MVPA minutes during the camp day compared with children attending SDCs enrolling <40 children. Further, children attending large SDCs (>60 children enrolled/day) accumulated at least 6 fewer MVPA minutes during the camp day compared with smaller SDCs (<40 children enrolled/day). Children attending SDCs that scheduled greater >4 hours for PA ($n=8$) were more active during the camp day than children attending SDCs that scheduled <2 hours for PA opportunities (Table 2).

DISCUSSION

This is one of the first studies to report accelerometer-derived MVPA estimates of children attending SDCs. Findings show that a substantial portion of boys and girls (>70%) achieve and surpass the daily MVPA guidelines during their time at SDCs. Other notable findings include the influence of SDC location, where SDCs operating at non-traditional locations resulted in up to 30 and 48 fewer minutes of MVPA/day for girls and boys, respectively. Further, compared with children in smaller programs, children in larger programs (>60 children) had fewer MVPA minutes during the camp day and children in medium-sized programs (40–60 children) had more MVPA minutes during the camp day. Lastly, scheduled

PA opportunities >4 hours/day were associated with higher levels of accumulated MVPA minutes during the camp day for boys and girls across all percentiles.

The MVPA estimates reported herein are higher than previously reported accelerometer-derived estimates from a smaller sample of SDCs ($n=3$).⁵ This could be due to a higher mean wear time in the present study compared with Beets and colleagues¹¹ (501 vs 340 MVPA minutes), or the different accelerometer placement site (i.e., non-dominant wrist versus hip). Nonetheless, the fact that a large portion of both boys and girls in this study accumulated meaningful amounts (i.e., 60 minutes/day) of MVPA at SDCs is an encouraging finding in light of previous research reporting the majority of children are falling short of PA recommendations in a variety of settings.^{4,12–15} Several studies have shown a gender difference in PA among children and adolescents,^{4,12,13} yet the findings herein present a minimal difference suggesting that SDCs have the potential to lessen the disparity in PA levels between boys and girls.

Significant reductions in accumulated MVPA minutes in both boys and girls not present on BMI measurement days (classified as “missing”) were observed in this study. Further examination of children with and without BMI data revealed a statistically significant difference in the proportion of children who were African American, non-Hispanic white, and other. In the sample of children missing BMI data, there was a greater proportion of non-Hispanic white (34% vs 26%) and other (11% vs 7%), and a lower proportion of African American children (55% vs 67%), compared with the sample of children with BMI data. One possible explanation of the observed lower PA levels among children missing BMI information may be this disproportion. Approximately 83% of children ($n=68$) in the “other” category were Hispanic and the present data show that children classified as non-Hispanic white or other children exhibit lower PA levels than African American children. Further, this finding is consistent with data from a large study that stratified child-level accelerometer-derived MVPA estimates by race/ethnicity, whereby African American children exhibited the highest PA levels, followed by non-Hispanic white, and Mexican Americans.⁴ Nonetheless, there may be other demographic differences not examined that could explain the differences in PA among children with and without BMI data. Finally, it is worth noting that boys and girls who were classified as overweight/obese did not differ significantly in their accumulated MVPA minutes, across all percentiles, compared to underweight/normal-weight children. This is consistent with the after school program literature where no differences were found in children’s accumulated MVPA across weight classifications.^{13,15}

Children attending SDCs operating out of non-traditional locations and schools accumulated fewer MVPA minutes during the camp day compared with those SDCs operating out of community centers. The three non-traditional locations consisted of two SDCs from a military base and one SDC operating in a strip mall. The observed association seems to be more restrictive on accumulated MVPA minutes for the more-active children (especially boys), suggesting that a lack of appropriate PA space (e.g., gymnasium) or access/permission to use existing facilities (e.g., in schools) could be limiting children’s MVPA, where research has found a positive association between indoor space (square footage) and accumulated MVPA minutes.¹³ Another notable finding was the influence of the number of children attending SDCs on accumulated MVPA minutes during the camp day. It appears

that SDC attendance of between 40–60 children is the “sweet spot” for boys’ and girls’ accumulation of MVPA. This could be attributed to other operational factors such as child-to-staff ratios (one staff member to ten children, American Camping Association)¹ or staff characteristics and PA-promoting behaviors. Lastly, children attending SDCs that scheduled >4 hours for PA accumulated substantially higher amounts of MVPA. Girls attending these SDCs were four times as likely to meet the daily PA guidelines compared with girls attending SDCs scheduling <2 hours for PA. Although intuitive, this finding holds clear implications for practice, as minor adjustments to an SDC’s daily schedule to increase the time allocated for PA may lead to substantial increases for both boys’ and girls’ daily MVPA.

CONCLUSIONS

In total, SDCs are well positioned to provide children with health-enhancing levels of MVPA during the summer months. Of note, the MVPA estimates herein represent the time the children are in attendance at the SDC. Conceivably, children have further opportunities outside of SDC hours to accumulate additional MVPA minutes. Strengths of this study include the large, diverse sample of children and SDCs, and the use of accelerometers to capture children’s MVPA. However, the MVPA estimates represent children attending SDCs in one southeastern state and may not represent estimates of children’s MVPA attending SDCs in other regions of the U.S. Further, PA estimates were captured by device placement on the non-dominant wrist; therefore, results must be interpreted with caution when attempting to compare with other literature using alternative device placements (e.g., hip). In conclusion, findings suggest that the majority of children attending SDCs accumulate health-enhancing levels of PA. In light of these findings, public health practitioners should focus efforts on making SDCs an accessible and prevalent setting for all children in the U.S.

ACKNOWLEDGMENTS

Research reported in this publication was supported by NIH under award number R01HD079372. The content is solely the responsibility of the authors and does not necessarily represent the official views of NIH.

REFERENCES

1. American Camping Association. [Accessed March 21, 2016] Fall Enrollment Summary Results. 2015. www.acacamps.org/
2. U.S. DHHS. [Accessed March 23, 2016] Physical Activity Guidelines for Americans. 2008. <https://health.gov/paguidelines/>
3. Beets MW, Weaver RG, Beighle A, Webster C, Pate RR. How physically active are children attending summer day camps? *J Phys Act Health*. 2013; 10(6):850–885. <https://doi.org/10.1123/jpah.10.6.850>. [PubMed: 23070923]
4. Troiano RP, Berrigan D, Dodd KW, et al. Physical activity in the United States measured by accelerometer. *Med Sci Sports Exerc*. 2008; 40(1):181–188. <https://doi.org/10.1249/mss.0b013e31815a51b3>. [PubMed: 18091006]
5. Beets MW, Morgan CF, Banda JA, et al. Convergent validity of pedometer and accelerometer estimates of moderate-to-vigorous physical activity of youth. *J Phys Act Health*. 2011; 8(Suppl 2):S295–S305. <https://doi.org/10.1123/jpah.8.s2.s295>. [PubMed: 21918244]
6. Baranowski T, Baranowski JC, Cullen KW, et al. The fun, food, and fitness project (FFFP): the Baylor GEMS pilot study. *Eth Dis*. 2003; 13(1; SUPP/1):S1–30.

7. Bailey RC, Olson J, Pepper SL, et al. The level and tempo of children's physical activities: an observational study. *Med Sci Sports Exerc.* 1995; 27(7):1033–1041. <https://doi.org/10.1249/00005768-199507000-00012>. [PubMed: 7564970]
8. Banda JA, Haydel KF, Davila T, et al. Effects of Varying Epoch Lengths, Wear Time Algorithms, and Activity Cut-Points on Estimates of Child Sedentary Behavior and Physical Activity from Accelerometer Data. *PLoS One.* 2016; 11(3):e0150534. <https://doi.org/10.1371/journal.pone.0150534>. [PubMed: 26938240]
9. Chandler J, Brazendale K, Beets M, Mealing B. Classification of physical activity intensities using a wrist-worn accelerometer in 8–12-year-old children. *Pediatr Obes.* 2015; 11(2):120–127. <https://doi.org/10.1111/ijpo.12033>. [PubMed: 25893950]
10. Geraci M, Bottai M. Linear quantile mixed models. *Stat Comput.* 2014; 24(3):461–479. <https://doi.org/10.1007/s11222-013-9381-9>.
11. Routen AC, Upton D, Edwards MG, Peters DM. Discrepancies in accelerometer-measured physical activity in children due to cut-point non-equivalence and placement site. *J Sports Sci.* 2012; 30(12):1303–1310. <https://doi.org/10.1080/02640414.2012.709266>. [PubMed: 22856351]
12. Brazendale K, Beets MW, Weaver RG, et al. Wasting Our Time? Allocated Versus Accumulated Physical Activity in Afterschool Programs. *J Phys Act Health.* 2015; 12(8):1061–1065. <https://doi.org/10.1123/jpah.2014-0163>. [PubMed: 25271393]
13. Beets MW, Weaver RG, Turner-McGrievy G, et al. Are We There Yet? Compliance with Physical Activity Standards in YMCA Afterschool Programs. *Child Obes.* 2016; 12(4):237–246. <https://doi.org/10.1089/chi.2015.0223>. [PubMed: 27096191]
14. Long MW, Sobol AM, Cradock AL, et al. School-day and overall physical activity among youth. *Am J Prev Med.* 2013; 45(2):150–157. <https://doi.org/10.1016/j.amepre.2013.03.011>. [PubMed: 23867021]
15. Trost SG, Rosenkranz RR, Dziewaltowski D. Physical activity levels among children attending after-school programs. *Med Sci Sports Exerc.* 2008; 40(4):622. <https://doi.org/10.1249/MSS.0b013e318161eaa5>. [PubMed: 18317385]

Table 1

Descriptive Characteristics of Summer Day Camps and Demographics of Attending Children

Characteristics/Demographics	Summer day camps		
N	20		
Mean number of children (range)	50	(14–175)	
Mean number of staff (range)	9	(3–16)	
Camp duration – mean weeks (range)	9.4	(7.5–10.0)	
Day duration – mean hours (range)	10.5	(8.8–12.5)	
Scheduled PA – mean minutes (range)	190.3	(0–360)	
Wear time – mean minutes (range)	501.3	(8.9–678.9)	

	Attending children		
	Total N	Boys N	Girls N
All children (%) ^a	1,061 (100)	569 (53.6)	492 (46.4)
Kindergarten	221 (20.8)	118 (20.7)	103 (20.9)
First grade	220 (20.7)	120 (21.1)	100 (20.3)
Second grade	209 (19.7)	115 (20.2)	94 (19.1)
Third grade	147 (13.9)	71 (12.5)	76 (15.5)
Fourth grade	139 (13.1)	69 (12.1)	70 (14.2)
Fifth grade	125 (11.8)	76 (13.3)	49 (10.0)
Age – mean years (±SD)	7.8 (1.8)	7.9 (1.8)	7.8 (1.8)
Ethnicity (%)			
African American	693 (65.3)	377 (66.3)	316 (64.2)
Non-Hispanic white	286 (27.0)	151 (26.5)	135 (27.4)
Other	82 (7.7)	41 (7.2)	41 (8.3)
BMI (%)			
Underweight	12 (1.1)	7 (1.2)	5 (1.0)
Normal weight	505 (47.6)	279 (49.0)	226 (45.9)
Overweight	155 (14.6)	83 (14.6)	72 (14.6)
Obese	205 (19.3)	95 (16.7)	110 (22.4)
Missing	184 (17.3)	105 (18.5)	79 (16.1)
Median MVPA minutes (±SD)	89 (38.7)	96 (41.7)	82 (33.3)
Number of children accumulating 60 minutes MVPA (%) ^a			
All	811 (76.4)	455 (80.0)	357 (72.6)
Kindergarten	162 (73.2)	93 (79.2)	69 (66.7)
First grade	167 (76.1)	93 (77.1)	75 (75.1)
Second grade	168 (80.2)	92 (80.0)	76 (80.4)
Third grade	100 (67.7)	49 (68.4)	51 (67.0)
Fourth grade	100 (72.0)	58 (84.3)	43 (60.9)
Fifth grade	87 (69.4)	58 (75.7)	29 (59.0)

^aGrade specified in table relates to the grade children will be entering post-summer.

PA, physical activity; MVPA, moderate-to-vigorous physical activity

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Table 2

Associations Among Demographics/SDC Characteristics and MVPA Minutes Children Accumulate While Attending

Demographic/ SDC characteristic	Mode 1	25th percentile		50th percentile		75th percentile		Accumulating 60 min/d MVPA	
	n	β	(95% CI)	β	(95% CI)	β	(95% CI)	O R	(95% CI)
Girls MVPA minutes (n=492)									
Age	492	-2.5	(-3.9, -1.2)	-2.5	(-4.2, -0.7)	-3.4	(-5.5, -1.4)	0.8	(0.7, 0.9)
BMI									
Normal/Underweight (Ref)	231								
Overweight/Obese	182	2.0	(-4.2, 8.1)	-0.8	(-8.2, 6.6)	-2.2	(-8.9, 4.6)	1.1	(0.6, 1.8)
Missing	79	- 15.7	(-26.7, -4.7)	- 12.9	(-23.9, -1.9)	-9.6	(-23.1, 3.9)	0.4	(0.2, 0.9)
Race/Ethnicity									
African American (Ref)	316								
Non-Hispanic white	135	- 1.04	(-7.8, 5.7)	1.2	(-6.0, 8.4)	-2.9	(-10.0, 4.3)	0.7	(0.3, 1.4)
Other	41	-6.6	(-14.8, 1.6)	- 11.7	(-22.0, -1.4)	- 12.6	(-28.0, 2.9)	0.5	(0.2, 1.3)
SDC location ^d									
Community (Ref)	9								
Faith-based	3	-4.3	(-14.2, 5.5)	-5.2	(-15.1, 4.8)	- 10.4	(-20.5, -0.3)	0.9	(0.3, 2.8)
School	5	-9.0	(-18.0, -0.1)	- 12.3	(-20.4, -4.1)	- 16.9	(-25.6, -8.2)	0.5	(0.2, 1.4)
Non-traditional ^b	3	- 22.4	(-29.9, -14.8)	- 29.5	(-39.1, -19.9)	- 28.9	(-39.5, -18.3)	0.1	(0.1, 0.3)
Attending children ^d									
<40 children (Ref)	7								
40-60 children	6	12.7	(5.1, 20.2)	15.3	(7.5, 23.2)	12.3	(-0.3, 24.9)	2.5	(0.9, 7.5)
>60 children	6	- 6.7	(-13.2, -0.2)	-4.2	(-12.7, 4.4)	-5.0	(-13.7, 3.8)	0.8	(0.3, 2.3)
Scheduled PA time ^d									
<2 hours (Ref)	4								

Demographic/ SDC characteristic	Mode 1	25th percentile		50th percentile		75th percentile		Accumulating 60 min/d MVPA	
	n	β	(95% CI)	β	(95% CI)	β	(95% CI)	O R	(95% CI)
2-4 hours	4	7.6	(-1.5, 16.7)	3.2	(-7.5, 13.8)	1.3	(-8.9, 11.5)	1.5	(0.4, 5.5)
>4 hours	8	15.7	(10.0, 21.4)	16.0	(6.3, 25.7)	18.6	(9.5, 27.6)	4.0	(1.4, 11.2)
Boys MVPA minutes (n=569)									
Age	569	-0.3	(-1.9, 1.2)	-2.1	(-4.0, -0.1)	-1.0	(-3.5, 1.4)	0.9	(0.8, 1.0)
BMI									
Normal/Underweight (ref)	286								
Overweight/Obese	178	-5.0	(-13.6, 3.7)	-3.6	(-13.2, 6.0)	-2.6	(-13.4, 8.2)	0.9	(0.5, 1.5)
Missing	105	-11.4	(-21.1, -1.7)	-13.3	(-23.7, -2.9)	-17.8	(-31.2, -4.5)	0.7	(0.4, 1.5)
Race/Ethnicity									
African American (Ref)	377								
Non-Hispanic white	151	-5.0	(-14.5, 4.6)	-5.1	(-12.9, 2.7)	-8.9	(-18.5, 0.6)	0.6	(0.3, 1.0)
Other	41	-8.1	(-20.2, 4.2)	-13.2	(-25.7, -0.7)	-17.0	(-34.2, 0.4)	0.6	(0.2, 1.5)
SDC location ^a									
Community (Ref)	9								
Faith-based	3	5.5	(-6.4, 17.4)	-3.3	(-14.6, 8.0)	-8.3	(-25.0, 8.5)	2.1	(0.6, 7.4)
School	5	-8.6	(-17.8, 0.6)	-17.3	(-28.6, -6.0)	-23.1	(-35.6, -10.7)	0.2	(0.2, 1.5)
Non-traditional ^b	3	-29.4	(-36.7, -22.2)	-43.3	(-53.1, -33.6)	-48.2	(-58.6, -37.8)	0.1	(0.1, 0.4)
Attending children ^d									
<40 children (Ref)	7								
40-60 children	6	12.5	(3.5, 21.5)	20.2	(9.9, 30.5)	20.5	(4.3, 36.7)	1.6	(0.5, 5.3)
>60 children	6	-9.6	(-17.8, -1.3)	-9.0	(-19.0, 1.0)	-13.0	(-26.3, 0.2)	0.6	(0.2, 2.1)
Scheduled PA time ^d									
<2 hours (Ref)	4								

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Demographic/ SDC characteristic	Model	25th percentile		50th percentile		75th percentile		Accumulating 60 min/d MVPA	
	n	β	(95% CI)	β	(95% CI)	β	(95% CI)	OR	(95% CI)
2-4 hours	4	13.2	(2.0, 24.4)	8.7	(-4.3, 21.7)	1.7	(-15.3, 18.8)	1.6	(0.4, 7.0)
>4 hours	8	26.8	(18.9, 34.8)	31.5	(22.0, 40.9)	30.1	(21.6, 38.6)	3.3	(1.0, 10.6)

Notes: All estimates control for time-in-attendance and clustering at the child and site level.

Boldface indicates statistical significance ($p < 0.05$).

^aModel controlled for age, BMI, and race/ethnicity.

^bTwo SDCs operated on a military base, and one in a strip mall

PA, physical activity; MVPA, moderate-to-vigorous physical activity; min/d, minutes per day; SDCs, summer day camps