CHILDHOOD OBESITY
August 2015 | Volume 11, Number 4
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DOI: 10.1089/chi.2014.0143

Prevalence of Compliance with a New Physical Activity Guideline for Preschool-Age Children

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Abstract

Background: Four expert panels from Australia, Canada, the United Kingdom, and the United States issued physical activity (PA) recommendations for young children that are quite similar. The aim of this study was to determine compliance with the new PA guideline (defined as ≥15 min/hr of total PA) in two independent samples of preschool children.

Methods: We conducted a cross-sectional study of children attending preschools in Columbia, South Carolina. A total of 286 children in one sample and 337 children in a second sample participated. The main outcome of interest was total PA (sum of light, moderate, and vigorous intensity activity) measured by accelerometry. Compliance with the PA guideline was determined for both samples. Separately for each sample, mixed logistic models were used to determine whether there were differences in compliance with the PA guideline between groups based on sex, race/ethnicity, parent education, and weight status, controlling for preschool.

Results: Total PA was 14.5 and 15.2 min/hr in the first and second samples, respectively. The prevalence of meeting the PA guideline was 41.6% and 50.2% in the first and second samples, respectively. In both samples, more males than females met the guideline (53.5% vs. 33.5% and 57.6% vs. 45.9%) in the first and second samples, respectively ($p < 0.05$).

Conclusions: Approximately one half of children in two independent samples met the guideline for PA in young children. Policies and practices designed to increase PA among preschool children are needed, given that most children are not meeting this PA guideline.

Introduction

Obesity rates have increased in all segments of the US population, including children of preschool age. Currently, 22.8% of US children ages 2–5 years are overweight or obese (≥85th percentile).[1] Though the reasons for this alarming trend are not certain, expert panels have suggested consistently that declining physical activity (PA) is likely an important contributor.[2,3]

Recommendations regarding the type and amount of PA young children should obtain have been highly variable, and organizations have issued very divergent PA guidelines.[4,5] Recently, however, four independent expert panels from four different countries (Australia, Canada, the United Kingdom, and the United States) issued PA recommendations for young children that are quite similar.[3,6–8] Although these new guidelines are expressed differently, they recommend the same amount of daily PA for children 3–5 years of age: 3 hours of total PA per day.[9] The guideline from a US-based organization, the Institute of Medicine (IOM),[3] recommends that child care centers provide preschoolers with "opportunities for light, moderate, and vigorous physical activity for at least 15 minutes per hour while children are in care." If extrapolated to 12 waking hours, this guideline equates to the same number of hours of total PA per day recommended by the guidelines issued in the other countries.

Few studies have examined the prevalence of young children meeting PA recommendations,[10–14] and none have determined the prevalence of young American children meeting this new PA guideline. Accordingly, the aim of this study was to determine the rates of compliance with a new PA

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guideline in two independent samples of preschool children, using PA measured objectively with accelerometry.

Methods

Study Design and Participants

Cross-sectional analyses were performed in two independent samples of preschool-age children. Participants in the first sample were enrolled in the Children's Activity and Movement in Preschool Study (CHAMPS), an observational study of 3- to 5-year-old children attending preschools in or near Columbia, South Carolina. Twenty-two preschools participated in the study, including commercial ($n = 11$), faith-based ($n = 7$), and federally supported Head Start programs ($n = 4$). Data were collected at each preschool during two data collection waves of 2 weeks' duration each, separated by 13–19 months. The CHAMPS sample consisted of 286 children. Data were collected from August 2004 to January 2006; data from both waves were used. Participants in the second sample were enrolled in the Study of Health and Activity in Preschool Environments (SHAPES), a 3-year intervention study designed to increase PA and decrease sedentary behavior in preschool children. SHAPES was conducted in 16 preschools (eight public and eight private preschools) in or near Columbia, South Carolina. The SHAPES sample consisted of 337 children; we included baseline data from children in both intervention and control preschools. Data collection was conducted between September 2008 and August 2011. For both studies, written informed consent was obtained from each child's parent or guardian before data collection. The studies were approved by the University of South Carolina Institutional Review Board.

Measures

Accelerometry. In the CHAMPS sample, children wore ActiGraph accelerometers (Model 7164; ActiGraph LLC, Pensacola, FL) over a 2-week period, including one weekend. In the SHAPES sample, children wore ActiGraph accelerometers (models GT1M and GT3X; ActiGraph LLC) over 5 consecutive weekdays. The ActiGraph is a uniaxial accelerometer that measures acceleration in the vertical plane. The monitors were initialized to save data in 15-second intervals to detect the short bursts of activity that are characteristic of 3- to 5-year-old children.[15]

For both samples, children wore the accelerometers on an elastic belt on the right hip. Parents were instructed to remove the accelerometer during water activities (*e.g.*, bathing or swimming) and at bedtime. For both samples, accelerometer data were reduced using a cutpoint for total PA (≥200 counts/15 s), which was developed specifically for 3- to 5-year-old children.[16] Periods of 60 minutes or more of continuous zeroes were considered nonwear times and were excluded from the analyses. Total day min/hr of total PA was calculated, using each child's daily wear time as the divisor.

Protocols differed markedly with regard to the number of days measured (12 days for CHAMPS and 5 days for SHAPES). To ensure consistency with SHAPES data, only data from Monday to Friday of the first observation week of CHAMPS were included. For both samples, a valid observation day was defined as wearing the accelerometer for ≥8 hours. Children with at least 2 valid days were included in the analysis. Total PA (min/hr) was averaged across the valid days, and then compliance with the PA guideline was defined as an average of ≥15 min/hr of observation.

Additional variables. Children's height and weight were measured by trained research assistants. Children's height was measured to the nearest 0.1 cm using a portable stadiometer (Shorr Productions, Olney, MD). Weight was measured to the nearest 0.1 kg using an electronic scale (Model 770; Seca GmbH & Co. KG, Hamburg, Germany). BMI (kg/m^2) was calculated from the average measures of height and weight. Overweight and obesity were defined using the age- and sex-specific 85th and 95th percentiles for BMI from the CDC Growth Charts, respectively. Each child's parent or guardian completed a survey to assess demographic characteristics. Parents reported their child's date of birth and race/ethnicity (categorized as African American, white, and other) and their own educational level (categorized as below or above 2 years of college education).

Statistical Analyses

Descriptive statistics were calculated for demographic variables, and total PA was calculated for each sample. Separately for each sample, analysis of variance was used to determine whether there were differences in total PA between groups formed on the basis of sex, race/ethnicity, parent education, and weight status. Mixed logistic models were used to determine whether there were differences in compliance with the PA guideline based on sex, race/ethnicity, parent education, and weight status. All models included preschool attended as a random effect. All data were analyzed using SAS software (version 9.3; SAS Institute Inc., Cary, NC).

Results

In the CHAMPS sample, 42.7% of children were male and 52.8% were African American, and mean age was 4.2 ± 0.7 years. Children wore the accelerometers for an average of 13.4 hours per day. In the SHAPES sample, 51.3% of children were male and 48.1% were African American, and mean age was 4.5 ± 0.3 years. Those children wore the accelerometers for an average of 12.4 hours per day. The characteristics of the two samples are shown in Table 1.

Total PA was 14.5 and 15.2 min/hr in the CHAMPS and SHAPES samples, respectively. Results were similar in

Table 1. Characteristics of Children in the CHAMPS and SHAPES Samples

Variables	CHAMPS (*n*=286)		SHAPES (*n*=337)	
	n	% or mean±SD	*n*	% or mean±SD
Sex				
Male	122	42.7	173	51.3
Female	164	57.3	164	48.7
Race/ethnicity				
African American	151	52.8	162	48.1
White	112	39.2	119	35.3
Other	23	8.0	56	16.6
Parent education				
<2-year college degree	124	43.8	144	42.7
≥2-year college degree	159	56.2	193	57.3
Age, mean (SD), years	286	4.2±0.7	337	4.5±0.3
BMI, mean (SD), kg/m^2	286	16.5±2.9	337	16.3±1.9
Weight status				
Normal weight, <85th	205	71.7	241	71.5
Overweight, 85th–95th	48	16.8	54	16.0
Obese, ≥95th	33	11.5	42	12.5
Monitor wear, mean (SD), hr/day	286	13.4±1.3	337	12.4±1.3
Total PA, mean (SD), min/hr	286	14.5±3.5	337	15.2±3.0
PA guidelines[a]				
Meet guidelines, %	119	41.6	169	50.2
Do not meet guidelines, %	167	58.4	168	49.8

[a]Meeting guidelines defined as total physical activity ≥ 15 min/hr of observation.

CHAMPS, the Children's Activity and Movement in Preschool Study; SHAPES, the Study of Health and Activity in Preschool Environments; PA, physical activity; SD, standard deviation.

Table 2. Total Physical Activity, Mean (SE), min/hr

	CHAMPS		SHAPES	
	min/hr	*p* value	min/hr	*p* value
Sex				
Male	15.4 (0.4)	<0.001	15.9 (0.4)	0.001
Female	13.7 (0.3)		14.8 (0.4)	
Parent education				
<2-year college degree	14.6 (0.4)	0.54	15.7 (0.4)	0.17
≥2-year college degree	14.3 (0.3)		15.2 (0.4)	
Race/ethnicity[a]				
White	14.2 (0.4)	0.36	15.5 (0.5)	0.88
African American	14.7 (0.4)		15.4 (0.4)	
Weight status				
Normal weight, <85th	14.2 (0.3)	0.18	15.3 (0.4)	0.56
Overweight, 85th–95th	14.9 (0.5)		15.5 (0.5)	
Obese, ≥95th	15.2 (0.6)		15.8 (0.5)	

Adjusted for preschool.

[a]Children in the "other" category were excluded from this comparison owing to the small sample size.

CHAMPS, the Children's Activity and Movement in Preschool Study; SHAPES, the Study of Health and Activity in Preschool Environments; SE, standard error.

both samples, in that males accumulated more time in total PA than females ($p<0.01$; Table 2). The prevalence of meeting the new PA guideline was 41.6% and 50.2% in the CHAMPS and SHAPES samples, respectively. Results were similar in the two samples, with more males than females meeting the guideline ($p<0.05$; Table 3). In the CHAMPS sample, more overweight children (58.3%) met the guideline than normal weight children (37.9%; $p=0.01$). A similar trend was observed in the SHAPES sample, though the difference between weight status groups was not statistically significant.

Discussion

Obesity rates have increased in American children of preschool age,[17,18] and several expert panels have recommended increased PA as an important strategy for countering this significant public health problem.[2,3,5,19] Nonetheless, young children have not been included in public health surveillance systems designed to monitor physical activity in the United States. Further, the Physical Activity Guidelines for Americans recommend PA levels for children, but they apply only to children ages 6 and above.[20] Recently, however, an apparent international consensus has been achieved with regard to PA guidelines for 3- to 5-year-olds.[3,6–8] In the United States, Canada, Australia, and the United Kingdom, authoritative groups have issued recommendations that preschool-age children should be physically active for 3 hours per day, the equivalent of 15 min/hr for 12 waking hours.[3,6–8] The present study is, to our knowledge, the first to determine the prevalence of compliance with this new guideline in samples of American children. Using accelerometry to assess PA levels objectively, we found that approximately one half of children in two independent samples met this guideline.

Few studies have examined the prevalence of young children meeting the new PA guideline, and comparison of prevalence estimates is difficult owing to very divergent methods for (1) operationally defining the new guideline and (2) summarizing accelerometry data (*e.g.*, cutpoints).

Table 3. Prevalence of Meeting the Physical Activity Guideline of ≥15 min/hr of Total Physical Activity

	CHAMPS		SHAPES	
	% meeting	*p* value	% meeting	*p* value
Sex				
Male	53.5	<0.001	57.6	0.03
Female	33.5		45.9	
Parent education				
<2-year college degree	46.5	0.20	53.6	0.70
≥2-year college degree	38.6		51.2	
Race/ethnicity[a]				
White	40.3	0.60	51.9	0.79
African American	44.9		54.3	
Weight status				
Normal weight, <85th	37.9	[b]	49.7	[c]
Overweight, 85th–95th	58.3		59.4	
Obese, ≥95th	44.3		57.1	

Adjusted for preschool.

[a]Children in the "other" category were excluded from this comparison owing to the small sample size.

[b]In CHAMPS, more overweight children met the guideline than normal weight children ($p=0.01$); no other differences.

[c]In SHAPES, no differences among weight groups.

CHAMPS, the Children's Activity and Movement in Preschool Study; SHAPES, the Study of Health and Activity in Preschool Environments.

For example, in the present study, we considered a child compliant if his or her average time in total PA met the guideline. A recent study of Australian children also considered a child compliant if his or her average time in total PA met the guideline.[13] In contrast, researchers in a study of Canadian children defined compliance as meeting the guideline every day.[14] Accelerometer cutpoints also differed across the studies, with the lower cutpoints yielding higher prevalence estimates.[13,14] The use of accelerometry requires adopting decision rules for determining cutpoints for light, moderate, and vigorous intensities of activity. At present, there is no single, internationally accepted set of cutpoints for reducing accelerometry data in young children.[10,21] These different methods produced widely divergent prevalence estimates across the three studies. Compliance with the new PA guideline was 5.1% in the sample of Australian children,[13] 73% in the sample of Canadian children,[14] and in the present study 41.6% and 50.2% in the CHAMPS and SHAPES samples, respectively. Adoption of a standardized approach to reducing accelerometry data would facilitate cross-cultural comparisons of compliance with PA guidelines.

It is noteworthy that the prevalence of meeting the PA guideline was higher in overweight than normal weight children in both samples examined in this study. In the CHAMPS sample, this difference was statistically significant. Although this observation may seem counterintuitive, it is not without precedent in the literature. Previous studies examining the relationship between weight status and PA in children of preschool age have reported inconsistent findings.[22–28] Among studies using cross-sectional designs, some have reported negative associations,[26,27] no associations,[22,23] and positive associations.[24,28] These inconsistent, and sometimes unexpected, findings may be explained by developmental phenomena that confound interpretation of the observed relationships. For example, one hypothesis is that earlier developing children may tend to be both more physically active and heavier.[29] In any case, longitudinal studies with excellent measures of developmental status and body composition will be needed to fully elucidate the relationship between PA and weight status in young children. One such longitudinal study measured PA with accelerometers and adiposity with dual-energy X-ray absorptiometry in children ages 5, 8, and 11 years.[30,31] Children with the highest levels of PA at 5 years of age had lower fat mass at ages 8 and 11 than the children with the lowest levels of PA at 5 years of age.[30,31]

The increased prevalence of overweight and obesity among young children has prompted numerous authorities and expert panels to recommend specific actions, including increasing PA.[2,32,33] Recently, the Task Force on Childhood Obesity,[34] Let's Move Child Care,[35] the IOM,[3] Caring for Our Children,[5] Head Start's I Am Moving, I Am Learning,[36] and the US National Physical Activity Plan[19] have focused attention on PA policies as part of obesity prevention in young children. One important predictor of young children's PA is the child care center a child attends,[23,37] and the child care setting has been identified as a promising setting for increasing young children's PA.[38] The child care environment in the United States is influenced by regulations at the state level, and these regulations vary widely across states. A recent review of state regulations for child care centers found that most states required "active physical play."[39] However, most states do not require a specific amount of PA, and very few states specify programmatic or curricular actions that centers should take to provide their students with PA.[40] With this recent interest in promoting young children's PA, the findings of the present study support implementation of stronger, more accountable PA policies and practices to increase the proportion of young children who meet the new PA guideline.

This study has several strengths, including two diverse samples of children drawn from multiple preschools and the inclusion of commercial, faith-based, and federally supported Head Start programs. Further, it is a strength that PA was measured objectively by accelerometry. However, the generalizability of our findings may be limited, because all of the preschools were located in a single metropolitan area.

Conclusions

This was the first study to determine the prevalence of compliance with the new PA guideline in samples of American preschool-age children. We found that approximately one half of the children in two independent samples met the guideline of accumulating at least 15 minutes of total PA per hour of observation, on average. In both samples, more boys (53.5% and 57.6%) than girls (33.5% and 45.9%) met the PA guideline, but there were no differences across racial/ethnic and parent education groups. These findings point to the need to implement policies and professional practices aimed at increasing PA among preschool children, given that most of them are not meeting this new PA guideline.

Acknowledgments

This research was supported by two grants from the National Institute for Child Health and Human Development (NICHD) of the NIH (R01HD043125 and R01HD055451). The authors thank the children, parents, and preschools who participated in these studies. The authors also thank M. Joao Almeida, PhD, Janna Borden, and Kristen Swaney for their valuable contributions to the studies and Gaye Groover Christmus, MPH, for editing the manuscript.

Author Disclosure Statement

No competing financial interests exist.

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