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Correlates of Physical Activity in Latino Preschool Children Attending Head Start

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Abstract

Background—Physical activity is associated with long-term benefits for health and tracks from early childhood into later adolescence. Limited information exists about factors influencing physical activity among Latino preschoolers. We aimed to identify correlates of objectively measured light-to-vigorous-intensity physical activity as a proportion of wear time (% PA) in Latino 3–5 year olds.

Methods—Latino preschoolers (n = 96) were recruited from Head Start centers in Houston, TX, USA, from 2009 to 2010. Sociodemographics, anthropometrics, acculturation, neighborhood disorder, and TV viewing were measured. Actigraph GT1M accelerometers measured physical activity. Block linear regression was used with % PA as the dependent variable.

Results—Children achieved 285.7 ± 58.0 min/day of PA. In the final adjusted-model, child age, parental education and neighborhood disorder were positively associated with % PA (beta = 0.33, p = .002; beta = 0.25, p = .038; beta = 0.22, p = .039, respectively). TV viewing was inversely associated with % PA (beta=−0.23, p = .027).

Conclusion—The majority of Latino preschoolers in our study exceeded US national and international guidelines of physical activity duration. Future interventions to sustain physical activity should focus on the influence of age, socioeconomic status, neighborhood disorder, and TV viewing on Latino preschoolers' attainment of physical activity.

Keywords

TV viewing; screen media; Hispanic; disparity; obesity prevention

Physical activity in childhood has important physiological, psychological, and developmental benefits (20). Childhood physical activity is associated with lower cholesterol levels and blood pressure, improved bone mineral density and depression, and healthy weight maintenance (26). In adulthood, physical activity is associated with a lower risk of major chronic diseases such as cardiovascular disease, obesity, Type 2 diabetes mellitus, and several cancers (46,60). Evidence suggests that physical activity tracks from

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early childhood into later adolescence, making early childhood a crucial time period for the development of health-promoting behaviors (27,53).

A study in New Zealand found that physical activity declined by 50%, from age 3 years old to 5 years old, demonstrating the importance of understanding factors that impact physical activity among preschoolers (54). Preschool children can be quite sedentary, which highlights the importance of understanding preschoolers' physical activity to influence health outcomes across the life course (12). Studies from the UK, US, and Australia on preschool children's physical activity reported that variables at multiple levels (e.g., individual, social, family, preschool, and environmental/neighborhood factors) influence preschoolers' physical activity intensity level and duration (24,50,59). Preschool attendance has been shown to affect the intensity level and duration of physical activity achieved (41), and demonstrates an important area to further explore to promote physical activity in preschool children. In the US, 42% of 4 year old children (1.7 million children) attended preschool programs, i.e., pre-Kindergarten, pre-Kindergarten special education or, Head Start in 2012 (5). Both the high proportion of children attending preschool in the US and the importance of preschool physical activity on the development of long-term behavior underscores the importance of studying physical activity among preschool children.

Latinos are the largest and fastest growing ethnic minority in the United States (17). In the 2010 census, 25% of US children were Latino (25). Prior studies have suggested that Latino preschoolers are less physically active than their non-Latino white peers, and Latino inner-city school children are less physically active than their non-Latino black peers (49,57). Latino children have a higher prevalence of obesity compared with their non-Latino white peers, and are therefore at increased risk of cardiovascular disease, Type 2 Diabetes Mellitus, and other chronic diseases across the lifespan (13,38). Further, among Latino middle school students, acculturation to the US was significantly associated with lower frequency of physical activity and more TV viewing, suggesting an adverse influence between acculturation, TV viewing, and physical activity (51). While prior studies among preschool-age children identified correlates of physical activity including sex, age, race, child BMI, and family behavior, studies among Latino preschool children are sparse (7,21,44,50). Previous studies have found that health-related interventions designed to acknowledge the cultural and linguistic commonalities among Latinos can be more effective than nonculturally adapted approaches (47). Thus, an improved understanding of factors influencing physical activity among Latino preschoolers is needed to develop effective culturally adapted interventions and to address disparities in disease risk for this growing population (18).

We sought to identify correlates of objectively measured light-to-vigorous-intensity physical activity as a percentage of accelerometer wear time (% PA) in Latino 3- to 5-year-olds who attend Head Start. We hypothesized that age and parental education are positively associated with % PA (34,41,48). We also hypothesized that neighborhood disorder, TV viewing and BMI z-score are inversely associated with % PA (21).

Methods

Participants

Full recruitment details were published elsewhere (30,31). Briefly, we enrolled Latino preschool children and their parents from four Head Start centers in the Houston-metro area. Families were recruited with study flyers and by research staff from January 2009 to June 2010. They were included if they were of Latino or Hispanic ethnicity by parent report, if they had a 3–5 year old child, and if the parent was able to complete the survey in either English or Spanish. While participating families met income eligibility and poverty guidelines for the Head Start program, we additionally obtained parental education as a proxy for socioeconomic status. Parental education responses were divided into three categories for analyses (0 = 8^{th} grade or less, 1 = Less than college, 2 = any college). Parents provided informed consent and received a small incentive for their participation. The surveys underwent (a) forward translation from English to Spanish, (b) backward translation from Spanish to English, and (c) decentering, in which conceptual and not literal equivalence was emphasized, and the original text was modified to resolve any other translation issues, with particular attention given to cultural sensitivity (61). Families participated in the study over 7 days at Time 1 for the initial measurements, and again 3–4 weeks later to allow a break between the intensive measurement periods (30). The original study was approved by the Institutional Review Board of Baylor College of Medicine, and the present analyses were approved by the Institutional Review Board of Seattle Children's Hospital.

Anthropometrics

Trained staff measured parent and child height on a portable stadiometer (Seca model 214, Birmingham, UK) and weight using a digital scale (Tanita model BWB-800S, Arlington Heights, IL). The mean of the two measures taken by the same staff member during the same visit was calculated and used in the analyses. If there was a difference of >0.2 cm for height or 0.2 kg for weight, then a third measurement was taken, and the mean of the closest two values was used in the analyses. Height and weight were used to calculate parent and child BMI (kg/m^2). The children's age-and sex-specific BMI z-scores were determined using the US Centers for Disease Control and Prevention growth chart data (28).

Acculturation

A demographic survey completed by parents in English or Spanish included proxy items on acculturation: [1] country of birth (non-US including Puerto Rico = 0 and US = 1); [2] years living in the US (parents: <15 years = 0 and ≥ 15 years = 1), and [3] preferred language (Spanish only/more than English = 0, English and Spanish equally or English more than Spanish = 1) (30,31). For "years living in the US," 15 years was chosen for the parent cut point because 48.2% of parents had lived in the US for <15 years. The parent global measure was summed, and higher scores indicated greater acculturation (31).

Neighborhood Disorder

A validated 8-item neighborhood disorder scale was used to assess parental perceptions of neighborhood safety (14). Among the same Latino preschool sample of the current study, the scale had good internal consistency (Cronbach's alpha = .87), and acceptable test-retest reliability 3–4 weeks apart (ICC = 0.66, $p < .001$) and the expected positive association with child BMI z-scores (beta = 0.30, $p = .005$) (31).

TV Viewing

A 7-day TV viewing diary was used to measure children's TV viewing, since TV diaries have the highest correlation with the criterion standard measurement of direct observation (9). Parents recorded their child's TV viewing in 15-min increments from 6 a.m. to 12 a.m. daily. The measurements were recorded for 7 days (Time 1) and then repeated 3–4 weeks later (Time 2) for test-retest reliability (intraclass correlation = 0.82, $p < .001$) (2,30). The TV diary used in the current study had convergent validity with the TV Allowance device ($r = .45–0.55$, $p < .001$) and ecological momentary sampling ($r = .47–0.51$, $p < .001$) (30). The data from Time 1 and Time 2 were averaged to determine daily TV viewing minutes.

Physical Activity

Accelerometers (Actigraph model GT1M, Actigraph LLC, Ft. Walton Beach, FL) were used to measure children's physical activity. Accelerometers recorded data in 15 -second epochs and were worn daily at the hip over Times 1 and 2 (3). Previous studies validated accelerometers for the objective assessment of physical activity in preschoolers using 15-s epochs (1,39,45). Three or more hours of accelerometer wear for a minimum of five days was considered the minimum threshold for valid wear time and inclusion in the analyses based on previous studies on preschool-age children that reported a reliability of over 70% for this threshold (22,42). We defined a nonwear period as 60 consecutive minutes of zero accelerometer counts, aside from 1 to 2 min of counts between 0–100 per Troiano and colleagues (56). We included all nonsedentary time to create the light-to-vigorous-intensity physical activity (PA) variable with a cutpoint of >37.5 counts/15 s (39). We calculated mean PA by using data from Times 1 and 2, and % PA was calculated by dividing the mean number of minutes/day in PA by the number of minutes/day the accelerometer was worn and multiplied by 100 (22). To compare school versus nonschool time, school time was calculated as the weekday time from 9am–1pm. Nonschool time was all weekday time that did not include school time. Data from 12am–6am was excluded for all children.

Analyses

We present descriptive information for the overall sample included in the regression models. We used *t* tests to compare mean number of minutes of PA during school time versus nonschool time, and weekend versus weekday hours, and we report mean ± *SD*. We calculated mean minutes of PA per hour for each specific time frame as shown in the following example: for school time, the numerator was minutes of PA during school time and the denominator was minutes of wear time during school time. We used block linear regression analysis with the child's % PA as the dependent variable. Covariates were sequentially added and retained in four blocks. The first block included covariates most

closely related to the individual: child's age and sex, and parent's education and BMI. The second block included covariates most related to the environment: neighborhood disorder, and parent acculturation. The third and fourth block included modifiable variables thought to be most associated with PA: child's BMI z-score, and TV viewing (minutes/day), respectively (29,31). We conducted the same block linear regression with % moderate-to-vigorous physical activity (MVPA) as the dependent variable and included results as supplementary material. We report standardized beta coefficients for the block linear regression, which represent the number of standard deviations the dependent variable will change for each one standard deviation change in the independent variable.

We used National Cancer Institute SAS programs for analyzing accelerometer data in SAS 9.0 (Unix, Cary, NC), and modified them to meet our study criteria (33). We used Stata 12.0 (Statacorp LP, College Station, TX) for analyses. A significance level of $p < .05$ was chosen. Due to the exploratory nature of this study, we also reported relationships with $0.1 > p \geq .05$ as being of potential interest for further investigation in future studies with larger samples sizes.

Results

Of the 96 children enrolled in the study, 87 had sufficient quality accelerometer data and 81 children had sufficient covariate data to be included in the regression analyses. The average age of the 81 participants was 4.7 years ± 0.5 and 42.0% were female (Table 1). For over one-third of families (34.6%), the parent reported less than an eighth grade education. The majority of parents were born in Mexico (60.5%), while the majority of children were born in the US (91.4%). Mean TV viewing time was 108.8 ± 93.0 min/day. The mean wear time for the accelerometers was 699.3 ± 124.6 min/day. The participants mean daily time in PA was 285.7 ± 58.0 min/day and 15.9 ± 3.2 min/hr. Mean PA on weekdays was 284.3 ± 55.1 min/day or 24.6 ± 3.2 min/hr compared with mean PA on weekends which was 339.9 ± 102.8 min/day or 25.8 ± 7.5 min/hr (*t* test comparing minutes/hr, $p = .03$). Weekday school time mean PA was 98.4 ± 18.1 min/day or 24.9 ± 4.7 min/hr compared with 255.3 ± 46.7 min/day or 24.5± 3.5 min/hr for weekday nonschool times (*t* test comparing minutes/hr, $p = .69$). Children in our study overall spent 41% of their time in PA, 30.5% was in light-intensity physical activity (LPA) and 10.5% in MVPA.

The block linear regression Model 1 (Table 2), which included child age, child sex, parent education, and parent BMI as covariates, yielded a significant association for age (beta 0.34, $p = .002$) with % PA. Model 2, which added neighborhood disorder and parent acculturation, similarly yielded significant associations with % PA for age (beta = 0.33, $p = .002$), parent education (beta = 0.24, $p = .045$), and neighborhood disorder (beta = 0.22, $p = .036$). Parent acculturation had $p < .1$ (beta=−0.19, $p = .079$).

Model 3, which added child BMI z-score, had significant associations for % PA with age (beta = 0.33, $p = .002$), and parental education (beta = 0.25, $p = .040$). Neighborhood disorder and parent acculturation had $p < .1$ (beta = 0.20, $p = .060$, and beta=−0.20, $p = .071$, respectively). In Model 4, age (beta = 0.33, $p = .002$), parental education (beta = 0.25, $p = .038$), and neighborhood disorder (beta = 0.22, $p = .039$) were significantly and positively

associated with % PA. TV viewing was significantly and inversely associated with % PA (beta=−0.23, $p = .027$). Parent BMI had $p < .1$ (beta = 0.19, $p = .080$). Throughout all four models, age had the strongest associations with % PA. In addition in Model 4, parental education, neighborhood disorder, and TV viewing have similar strong associations with % PA. Model 4 accounted for 23% of the variability in % PA, compared with 18% for Model 3, 19% for Model 2 and 11% for Model 1.

In the block linear regression for % MVPA, age was significantly and positively associated with % MVPA in all four models. No other variables reach statistical significance at $p < .05$, although sex, parental education, neighborhood disorder, and TV viewing all had associations with $p < .1$. The pattern of the associations for age, parental education, neighborhood disorder, and TV viewing is the same as for % PA; however, the magnitude is slightly lower. This data were included as Supplementary Table 1.

Discussion

We identified several important correlates of PA among Latino preschool children using an objective measure of physical activity (accelerometers). Age, parental education, neighborhood disorder, and TV viewing were all significantly associated with % PA in the final model, and parent BMI had $p < .1$. Age had the strongest positive association with % PA, i.e., older children engaged in greater amounts of physical activity, which was consistent with a cross-sectional study in South Carolina preschoolers that found a positive association between MVPA and age (44). Age, however, has not been consistently associated with physical activity among preschoolers (21,41). Two cross-sectional studies (physical activity as PA) and one longitudinal study (physical activity as MVPA) found older age to be associated with less physical activity (23,24,53). In our study, we identified a positive association between parental education and % PA, which was consistent with a cross-sectional study from the UK, which reported that higher parental education was related to higher LPA and MVPA (19). The association between parental education (as a proxy of socioeconomic status) and % PA suggests that Head Start may play an important role in promoting physical activity achievement among low income preschoolers.

Higher neighborhood disorder was positively associated with % PA; this finding was the opposite of the relationship anticipated *a priori*. This finding, however, is supported by another Houston, TX study wherein parent engagement in promoting physical activity was associated with more neighborhood disorder (35). In addition, a study of the Early Childhood Longitudinal Study—Kindergarten data found that parental perceptions of worse neighborhood safety were associated with increased days of physical activity for immigrant children (8). One potential explanation for this association, especially in this age group, is that parents tend to supervise outdoor playtime. Previous research has established a positive cross-sectional association between outdoor time and physical activity in children (4,11), and parents of highly active children may likewise spend more time outdoors, and may be more aware of their neighborhood surroundings than inactive children.

Greater TV viewing was associated with lower % PA in this sample of low-income Latino preschoolers. This finding is similar to an Australian study of preschoolers that found an

inverse association between TV viewing and both LPA and MVPA, as well as a previous meta-analysis that found an inverse association between TV viewing and physical activity among children ages 3- to 18-years old (15,29). Since there is a finite amount of time in the day, it is plausible that physical activity could be displaced by sedentary time even among preschool age children. Given that our work is cross-sectional, experimental studies are necessary to test and confirm this finding among Latino preschoolers.

Children in our study exceeded US and international recommendations for daily PA. The US National Association for Sport and Physical Education (NASPE) recommends at least 120 min of physical activity daily for preschoolers (6). The Australian, Canadian and United Kingdom (international) physical activity guidelines for children 0–5 years old recommend at least 180 min in physical activity daily (16,32,55). Among our study participants, 90.1% (73/81) met the NASPE guidelines daily for at least five days, and 85.2% (69/81) met the international guidelines daily for at least five days. Most children attained the recommended amount of physical activity daily, and had more physical activity on the weekends compared with weekdays (on a per hour basis) in our study. While the duration of physical activity is defined by NASPE and the international guidelines, the intensity is not (6). Research about the intensity of physical activity preschoolers need to achieve for the most ideal health benefit is needed.

Even though most Latino preschoolers in our study exceeded NASPE and international PA guidelines, we found differences in mean total physical activity achieved by children in our study compared with other studies. The mean PA minutes/day achieved by preschool children in our study (285.7 min/day) was lower than the 371.2 min achieved by 3- to 5-yearold children attending Head Start in a South Carolina study based on the same Pate et al. accelerometer cutpoints (6,39). The difference between preschool children in the South Carolina study compared with our study may be due to the differences in the population studied with a higher proportion of African-American children in the South Carolina study who have previously been shown to be more physically active (57), as well as potential differences in environment and policies across Head Start programs.

In comparison with an Australian study, preschool children in our study achieve a higher mean PA minutes/day overall of 285.7 min/day compared with the 127.2 min/day achieved by the Australian preschool children (23). Children in the Australian study also spent a 113 min/day watching TV as compared with the 108.8 min/day spent watching TV by children in our study. The difference in PA may be due to the Australian study using a higher cutpoint to define LPA. The development of standard cutpoints across studies will help facilitate future comparisons. In addition, this difference in PA, with little difference in TV time between the two study populations, suggests that other sedentary behaviors besides TV viewing may negatively influence Australian preschoolers' PA.

A similar size study of preschool children in Belgium found a lower percentage of children achieving at least 120 min of physical activity daily (27%) (10), than the majority of children (91%) who achieved that recommendation in our study. Belgian children spent more overall time in sedentary activity 84.7% compared with only 59.0% in our study (10). Some of this sedentary time may be explained by the 140 ± 78 min spent watching TV by

the Belgian children compared with 108.8 ± 93 min by the children in our study. In addition, the cutpoints used in the Belgian study were different than our study. The Belgian study had a higher cutpoint for LPA than that used in our study, and this difference in cutpoint for LPA may contribute to why fewer children in the Belgian cohort achieved the recommended amount of physical activity daily and spent more of their day in sedentary time. The cutpoints used in the Belgian study were validated by direct observation (52), while those used in our study were validated by indirect calorimetry (39,40). The difference in climate between the Belgian study (temperate) and our Houston, TX study (subtropical) may also help explain differences in PA between the studies.

Our study is limited in generalizability given that it was conducted only in Head Start preschools in the Houston-Metro area. We were unable to include 15 children in our analyses due to insufficient accelerometry or covariate data. Further it did not include any built environment measures or measures of parenting practices, both of which may influence children's PA (36,37,58). The cross-sectional design limits our ability to determine the directionality of associations. Strengths of our study include the objective measurement of physical activity via accelerometers, the previously validated TV diary to measure TV viewing, as well as the previously validated wear time measures, and the focus on Latino preschoolers for whom there has been limited prior research in this area (43).

The vast majority of Latino preschool children in our study exceeded NASPE and international PA guidelines on both weekdays and weekends. They achieved the highest number of min/hr of PA on weekends, therefore, weekdays during Head Start or outside of Head Start times will both be important targets for future physical activity interventions. Given that TV viewing may displace physical activity in Latino preschoolers, future studies focused on increasing or sustaining physical activity among this population should consider strategies to limit their TV viewing while increasing physical activity.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Participant Characteristics of Latino Preschool Children in Head Start (*n* = 81)

Characteristic		***n* (%)**
Child sex	Male	47 (58.0)
	Female	34 (42.0)
Parent education	8th grade or less	28 (34.6)
	Less than college education	29 (35.8)
	Any college education	24 (29.6)
Parent preferred language	Spanish	62 (76.5)
	English	19 (23.5)
Parent country of birth	Mexico	49 (60.5)
	US except Puerto Rico	16 (19.8)
	Other	16 (19.8)
Parent time in US	< 15 years	39 (48.2)
	≥ 15 years	42 (51.9)
		Mean (*SD*)
	Age (years)	4.7 (0.5)
	Parent BMI (kg/m^2)	28.2 (6.5)
	Neighborhood disorder	12.8 (4.1)
	Parent acculturation	1.0 (1.1)
	Child BMI z-score	0.8 (1.1)
	TV viewing (minutes/day)	108.8 (93.0)
	Wear time (minutes/day)	699.3 (124.6)
	% PA	41.0 (5.7)
	% MVPA	10.5 (3.3)
	% LPA	30.5 (3.6)
	% Sedentary	59.0 (5.7)
	PA (min/day)	285.7 (58.0)
	MVPA (min/day)	72.8 (23.0)
	LPA (min/day)	212.9 (43.4)
	Sedentary (min/day)	413.7 (88.9)

Table 2

Standardized Beta Coefficients for Block Linear Regression of % PA Wear Time

	Model 1	Model 2	Model 3	Model 4
Age	0.34**	0.33**	0.33**	0.33**
Sex	−0.03	−0.03	−0.03	−0.04
Parents education referent: 8th grade or less				
less than college	0.17	0.24**	0.25**	0.25**
any college	−0.03	0.003	0.02	0.02
Parent BMI	0.14	0.19*	0.18	0.19*
Neighborhood disorder		0.22**	0.20*	0.22**
Parent acculturation		−0.19*	−0.20*	−0.17
BMI z score			0.007	0.04
TV viewing				−0.23**
Adjusted r^2	0.11	0.19	0.18	0.23

** $p < .05$;

* $p < 0.1$