Published in final edited form as:

Pediatr Exerc Sci. 2018 August 01; 30(3): 433–440. doi:10.1123/pes.2017-0242.

The Association Between Perceived Athletic Competence and Physical Activity: Implications for Low-Income Schoolchildren

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Abstract

Purpose: Socioeconomic status (SES) may impact children's physical activity (PA) behaviors and confidence to participate in PA. We examined how SES modifies the relationship between children's perceived athletic competence (PAC) and moderate to vigorous PA (MVPA).

Methods: Children ($N = 1157$; 45% male; grades 3–4) were recruited for the Fueling Learning through Exercise study. Free/reduced price lunch eligibility was used as an indicator of SES. Seven-day accelerometry (ActiGraph GT3X+) was used to measure daily MVPA, out-of-school MVPA (O-MVPA), and school-time MVPA. PAC was assessed using the Harter's Self-Perception Profile for Children (6 items, scored 1–4; median split: high and low PAC).

Results: MVPA and PAC differed between low-SES [$n = 556$; 41.6 (17.1) min/d; high PAC = 45%] and middle-SES children [$n = 412$; 49.6 (22.7) min/d; high PAC = 62%]. There was an interaction between SES and PAC for MVPA ($P < .001$) and O-MVPA ($P < .001$), but not for school-time MVPA ($P > .05$). Middle-SES children with high PAC were more likely to engage in MVPA ($\beta = 6.6$ min/d; 95% confidence interval, 3.9 to 9.3; $P < .001$) and O-MVPA ($\beta = 4.8$

min/d; 95% confidence interval, 2.8 to 6.8; $P < .001$), associations that did not exist for low-SES children ($P > .05$).

Conclusions: PAC was positively associated with daily MVPA and O-MVPA, but not among low-SES children. Research is needed to elucidate the factors that shape the relationship between PAC and MVPA.

Keywords

self-perceptions; youth; socioeconomic disparities

Research continues to show that the majority of children are routinely not meeting the recommendations for moderate to vigorous physical activity (MVPA) (37). Effectively addressing this dire public health issue requires a comprehensive understanding of the complex psychosocial factors that may impact these behaviors. Children's self-perceptions are crucial to the adoption and maintenance of physical activity (PA) behaviors as well as psychological well-being (8,25). One domain of self-perception is perceived athletic competence (PAC), defined as the confidence to perform sports and outdoor activities (3,16). PAC may be an important target for PA promotion given it is both an important outcome in itself and simultaneously supports PA in children (3,30). Notably, PA and PAC demonstrate a parallel, precipitous decline through the elementary school years, which may set the stage for long-term behaviors (26,37,44).

Socioeconomic status (SES) disparities in PA (6,40) underscore the need to disentangle the array of factors that affect children's activity levels. Differences in PAC by SES may be one of the pathways that drive children's PA potentially through disparities in the complex PA and social environments that support these behaviors. Therefore, it is important to understand how PAC translates to PA both within and outside of the school setting for low-SES and middle-SES children. School-based opportunities such as physical education, recess, and classroom-based PA should theoretically provide equitable access to children to support both PAC and PA. However, the relationship between PAC and daily out-of-school MVPA (O-MVPA) is important due to SES-related differences in safe and accessible PA resources, affordability of PA programs, as well as interpersonal factors such as PA social support (12,13,20,29).

Participation in organized sports/activities may underlie PAC as well as drive out-of-school PA behaviors in children (18,22,34). It is therefore particularly disconcerting that recent evidence shows a steady decline in youth (aged 6–12 y) participation in sports/ organized activities to a mere 27% (36). Studies suggest that the benefits of sports participation transcend physical benefits and correspond with social and psychological benefits, including important self-perceptions, such as PAC (9). These effects may be even more critical for underserved youth and provide support for important developmental outcomes, specifically through factors such as inspiring coaches and a motivational climate (1,15). Assessing SES differences in organized sports/activities participation may not only better elucidate the relationship between PAC and O-MVPA but also represent a logical target for interventions.

In this analysis, we assessed the association between children's PAC and MVPA, including school-time MVPA (S-MVPA) and O-MVPA, and whether SES modifies this relationship in a diverse sample of children. We further examined whether SES influences the relationship between participation in sports/activities and O-MVPA.

Methods

Setting and Participants

The analysis used baseline data from the Fueling Learning through Exercise (FLEX) study, a longitudinal cluster randomized controlled trial designed to evaluate the impact of innovative school-based PA programming on children's MVPA, cognitive function, and academic outcomes. Low-income to middle-income diverse school districts were targeted for the FLEX study. Participants in grades 3 and 4 were recruited in 2 waves (wave 1—winter 2015; wave 2—fall 2015/winter 2016) from 24 Massachusetts public schools. Informed consent and assent were obtained from parents and children, respectively. The study protocol was approved by the Tufts University Institutional Review Board and by the individual school districts where required. Additional methods for the FLEX study have been previously described (43).

Measures

Sociodemographic Data.—Demographic data were collected by parent report included in the informed consent paperwork. Child race/ethnicity was based on the categories of the National Institutes of Health (24) and aggregated into 5 groups: non-Hispanic white, black, Hispanic, multiracial/other, and unknown. Eligibility for free/reduced price lunch (FRPL) was used as an indicator of SES. FRPL eligible and non-FRPL eligible children are hereafter referred to as low-SES and middle-SES children, respectively.

Anthropometrics.—Height and weight were measured in triplicate in a private setting (43). Body mass index (BMI) was calculated and converted into a percentile and *z* score using the Centers for Disease Control and Prevention age- and sex-specific growth charts (23). BMI percentiles were classified accordingly as: <5th percentile as underweight, 5th to <85th percentile as normal weight, 85th to <95th percentile as overweight, and 95th percentile as obese.

PA: Accelerometer Measurement.—PA was measured by waist-worn triaxial accelerometers (ActiGraph GT3X + and GT3X-BT models; ActiGraph, LLC, Pensacola, FL), validated and calibrated for use among children (27). Participants were outfitted at scheduled data collection visits at each school and were asked to wear accelerometers during all waking hours, except when bathing and swimming, for 7 consecutive days.

PA Log.—A 7-day PA log was completed at the same time the accelerometer was worn to assist with documenting wear time and other physical activities. This log contained additional questions during wave 2 ($n = 773$) about the sports/activities (up to 3) that children engaged in during the accelerometer wear week. For each question, child-reported sports/activities were coded to the categories of “free play only/no sports,” “1 sport,” “2

sports,” and “3 sports.” Free play only consisted of unstructured activities including but not limited to playing on a playground, playing tag, jump rope, and skipping. Sports took precedence in the coding if listed with a free play activity. Therefore, if a child indicated a free play activity and one specific sport, then the response was coded as “1 sport.”

Data Reduction.—The protocol for tracking wear time and preparation of accelerometer data for generating school wear time, nonwear time, and PA intensity categories are reported previously (43). Data were classified into the following PA intensity categories using the cut points (15-s count cutoff) developed specifically for children by Evenson et al (10): sedentary (< 25 counts), light (26–573 counts), moderate (574–1002 counts), and vigorous (> 1003 counts).

Perceived Athletic Competence.—Children completed an 18-item questionnaire (Harter’s Self-Perception Profile for Children) designed to assess how children evaluate themselves in various self-perception domains including PAC, behavioral conduct, and global self-worth (16). This evaluation tool has informed much of the literature regarding PAC in children (2,4,5,17,31,32,39). Trained research assistants administered the questionnaires to participants in small groups, with each participant completing his or her own questionnaire. The Harter’s Self-Perception Profile for Children uses a structured-alternative format designed to minimize socially desirable responses and ensure internal consistency and reliability (16). The 6 items related to PAC were individually scored on a 4-point scale (1 = lowest score; 4 = highest score) and averaged to generate a PAC domain score. The PAC domain was then median split and categorized into low PAC and high PAC.

Data Analysis

Descriptive statistics of demographic information were stratified by SES and included sex, grade, race/ethnicity, weight status, daily MVPA, O-MVPA, S-MVPA, and PAC. *t* tests were used to compare whether daily PA (daily MVPA, O-MVPA, and S-MVPA) was different for low-SES and middle-SES children. Means and *SDs* are presented unless otherwise stated. The association between PAC and daily PA was examined using mixed effects models with identity as the link function and a Gaussian distribution family adjusting for sex, race, grade, FRPL, weight status, accelerometer wear time, precipitation (yes/no), average daily high temperature, and controlling for school-level clustering. FRPL was tested as an interaction term for all PA outcomes. Given previous research surrounding sex and BMI disparities in PAC and PA, we separately assessed whether sex and BMI modify the relationship between children’s PAC, daily MVPA, O-MVPA, and S-MVPA by testing it as an interaction term in the PAC models.

For children who reported sports/activities during the week of accelerometer measurement, we compared the number of sports/activities engaged in and O-MVPA between low-SES and middle-SES children. Mixed effects models with identity as the link function and a Gaussian distribution family were used to further examine the association between number of organized sports reported, PAC, and out-of-school PA using SES (FRPL eligibility) as an interaction term and adjusting for sex, race, grade, FRPL, weight status category, accelerometer wear time, precipitation (yes/no), average daily high temperature, and

controlling for school-level clustering. Statistical significance was set at $P < .05$. All analyses were performed using Stata/SE 14.0 for Windows (StataCorp, College Station, TX).

Results

Overall, 18.8% of children [$N = 1054$; 44% male; 8.7 (0.7) y; 41% overweight/obese; 57% FRPL eligible] met the daily 60-minute PA recommendation [44.9 (20.1) min/d] and even fewer met the 30-minute school-time recommendation [9%; 18.3 (8.6) minutes per school day]. Children's PAC was relatively balanced between the low (48.5%) and high (51.5%) domains with a mean PAC score of 2.9 ($SD = 0.6$; range = 1–4). Demographic characteristics of low-SES and middle-SES children with valid accelerometer wear time are shown in Table 1. Low-SES children were primarily Hispanic (32%) and more overweight/obese (47%) in comparison with middle-SES children (67% non-Hispanic white; 34% overweight/obese). There were SES differences in PAC [low SES, 45% high PAC (median PAC score = 2.8) vs middle SES, 62% high PAC (median PAC score = 3.2); $P < .0001$]. PAC also differed by sex (male, 57% high PAC vs female, 47% high PAC; $P < .01$) but did not vary by weight status (normal weight, 54% high PAC, vs obese, 50% high PAC).

There was a significant interaction between SES and PAC for daily MVPA ($P < .001$) and O-MVPA ($P < .001$), but not for S-MVPA ($P > .05$). The beta coefficients from the regression models revealed that middle-SES children who reported high PAC were more likely to engage in more minutes of daily MVPA compared with children who reported low PAC ($\beta = 6.6$ min/d; 95% confidence interval, 3.9 to 9.3; $P < .001$). This association between PAC and daily MVPA was not statistically significant for low-SES children ($P > .05$; Table 2). For O-MVPA, middle-SES children who reported high PAC were more active than children who reported low PAC ($\beta = 4.8$ min/d; 95% confidence interval, 2.8 to 6.8; $P < .001$), an association that also did not exist for low-SES children ($P > .05$). Given differences in PAC by sex in the current study, we separately examined whether the association between PAC, daily MVPA, O-MVPA, and S-MVPA was modified by sex. Overall, girls [39.8 (15.7) minutes of MVPA per day] were substantially less active than boys [51.3 (22.9) minutes of MVPA per day; $P < .0001$]. The interaction between PAC and sex was not significant for daily MVPA, O-MVPA, and S-MVPA ($P > .05$).

Self-Reported Sports and Associations With PA and PAC ($n = 599$) Results

Children with SES data and fully completed logs ($n = 599$) were included in analyses for examining the relationships among sports participation, PAC, and SES. SES characteristics were comparable to the larger sample (57% low SES and 43% middle SES). The top 10 organized sports/activities reported by children are presented in Table 3. The number of sports that children reported differed based on SES ($P = .008$). Approximately 58% ($n = 197$) of low-SES children reported participating in 1 or 2 organized sports compared with 70% ($n = 180$) of middle-SES children. Moreover, a higher percentage of low-SES children reported participating in free play only/no sports (35%; $n = 118$) compared with middle-SES children (22%; $n = 56$).

Spearman's rank correlations indicated that PAC category (high or low) was associated with the number of sports/activities that children reported ($r_s = .14$; $P < .001$). A chi-square test indicated that high PAC was found in only 33% ($n = 58$) of children who reported only free play/no sports compared with 62% ($n = 31$) of children who reported participating in 3 sports ($P < .001$). For both low-SES and middle-SES children reporting free play only/no sports, low PAC was the same (68% for both groups). However, PAC for organized sports revealed differences based on SES. High PAC was reported by 49% ($n = 60$) of low-SES children who indicated participation in 1 sport compared with 63% ($n = 74$) of middle-SES children.

The mixed effects model indicated that there was a significant interaction between the number of self-reported sports and SES and O-MVPA ($P < .05$; Figure 1). This relationship did not exist for S-MVPA ($P > .05$; data not shown). There was a distinct difference in the step-wise increase from participation in free play only/no sports to 3 sports for middle-SES children that was not apparent among low-SES children. For children who reported participating in 2 or 3 sports, middle-SES children had approximately 8 and 11 more minutes of O-MVPA, respectively (Figure 1). In addition, mixed effects models were used to examine the interaction between PAC and self-reported sports with O-MVPA. Despite correlations between self-reported sports participation and PAC, the interaction was not significant ($P = .13$).

Discussion

This study highlights an important relationship between PAC and PA in low-SES children, which may serve as a conduit for future work aimed at closing the gap in PA disparities. A key takeaway from this study is that low-SES children, even those who report high PAC and participation in organized sports, still participate in less PA compared with middle-SES children. The difference in daily MVPA between low-SES and middle-SES children amounted to 6 minutes per day, which is of practical significance given that less than half of children are meeting the MVPA recommendations (19,26). It is important to note that the FLEX study targets low- to middle-SES communities in general, and comparisons between low-SES and middle-SES children should be interpreted with this in mind. Yet, given that low-SES children had less daily MVPA and O-MVPA compared with middle-SES children, we believe that there are complex SES-driven differences in these children's PA opportunities that transcend the resources and infrastructure within these communities. Although beyond the scope of this study, understanding how the PA and social environment impact opportunities to be active may help to better elucidate these differences in PAC and PA based on SES differences.

We found that not only were there SES disparities in PAC but also in self-reported organized sports/activities participation, which may help better frame the relationship between PAC and PA. Out-of-school PA opportunities including organized and/or team sports provide an opportunity to boost athletic competence and motor skills (38) but may be less accessible for families in low-income communities and at schools serving more socioeconomically disadvantaged children (11,42). In the current study, differences in sports participation varied based on SES, corroborating this disparity. Furthermore, it would be expected that

sports participation corresponds with higher PAC and greater PA levels. However, self-reported sports did not correlate equally with PAC and PA and were both ultimately lower in low-SES children compared with middle-SES children. This points to the complex relationship between self-reported sports and PAC, and PA, and how these may be shaped by a number of social and environmental factors. It is also important to recognize that though the 2 aims of this study assessing how SES modifies the relationship between 1) PAC and MVPA and 2) self-reported sports/activities and O-MVPA are conceptually linked, the relationship between PAC and self-reported sports and O-MVPA was not significant despite the association between PAC and self-reported sports. Further evaluation of actual PA levels during sports/organized activities, activity structure, and environment for these sports may help to clarify how these activities contribute to athletic competence in these children.

The relationship between PAC and S-MVPA did not differ for high- and low-SES children. Schools offer PA opportunities that are available to all students, regardless of SES, through physical education and other school day opportunities such as recess, before/after school offerings, and in-class movement. Others have found that addressing PAC may still be important when it comes to the school environment (5,20). Children who have high PAC exhibit a greater enjoyment of physical education, which may represent an important correlate of PA behaviors in this setting (5,20). Schools can provide opportunities to augment children's PAC given the importance of self-perception to overall PA participation.

The relationship between PAC and PA may be affected by an array of factors, including sex and BMI, which we separately assessed in this study. These relationships are particularly important to understand given that our findings and others indicate striking differences in PA by both BMI and sex (19). We found that PAC was not affected by weight status, but did vary by sex with girls exhibiting less high PAC compared with boys (28,33,35). We did not find that the relationship between PAC and PA was stronger for boys compared with girls, contrary to previous research in this domain (3,7,14,21,25,41). However, programs that effectively enhance this important self-perception in girls may have particular benefit for increasing their PA.

This study had limitations. The questions used to determine PAC may be prone to misreport, and some studies suggest that children have less realistic perceptions of athletic competence compared with adolescents (3). However, the Harter's Self-Perception Profile for Children used to measure PAC is a valid and reliable tool that has been used widely across the literature surrounding self-perceptions in children and was designed to minimize the influence of social desirability in responses (16). Another limitation relates to the assumption of how self-reported sports were categorized (organized vs unorganized or "free play") and interpreted in this study. We did not collect information on the frequency of self-reported sports participation during the accelerometer wear week or verify whether these activities were taking place during school or out-of-school. For example, self-reported "basketball" was categorized as an organized sport but could have been a sport played during recess and thus correspond with S-MVPA versus O-MVPA. However, a strength of this log is that it captured additional context and detail of activities during the accelerometer wear-time period with limited burden on the child. Finally, an overarching limitation of this study is that it is cross-sectional; therefore, we must be mindful of how we interpret the

associations between PAC and PA. Longitudinal analyses are needed to understand whether changes in PAC can promote PA behaviors, particularly in low-SES children.

Conclusions

These findings suggest that PAC may not correlate with greater participation in PA among low-SES children and highlights the need for future work in this area. The association between PAC and PA in middle-SES children can be interpreted in different ways due to the bidirectional nature of this relationship and cross-sectional study design. This relationship may be attributable to a variety of social and environmental factors that may be more available or accessible to middle-SES children. This study has a number of strengths including a robust sample size and objective measure of PA via accelerometry. Furthermore, we were able to not only assess PAC as an important psychosocial correlate of PA behaviors but also complement these analyses with an understanding of the number and types of activities children reported. Our findings support the need to further understand the factors that shape children's self-perceptions and PA behaviors.

Acknowledgments

We would like to thank the project staff, including Peter Bakun, who helped with the data collection and management efforts. We would also like to thank our school contacts including our school champions and principals who collaborated with us for this project. This study is funded by the Eunice Kennedy Shriver National Institute of Child Health and Human Development of the National Institutes of Health, award number R01HD080180. Additional funding is provided by the Boston Foundation. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health or the Boston Foundation. Neither of the funders had a role in the design of the study or the writing of this manuscript, nor will they have a role in future data collection, analysis, interpretation of data, and the writing of publications. Trial Registration: [ClinicalTrials.gov](https://clinicaltrials.gov) Identifier: .

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Figure 1 —. Number of child-reported sports engaged in during week of accelerometer measurement and levels of O-MVPA for low-SES and middle-SES Massachusetts children ($n = 599$). O-MVPA indicates out-of-school moderate to vigorous physical activity; SES, socioeconomic status. ^aStandard error bar.

Table 1

Descriptive Statistics of Low-SES ($n = 556$) and Middle-SES ($n = 412$) Children From FLEX Elementary Schools

	Low-SES children ($n = 556$) n (%)	Middle-SES children ($n = 412$) n (%)
Sex		
male	226 (40.7)	199 (48.3)
female	330 (59.4)	213 (51.7)
Grade		
third	277 (49.8)	199 (48.3)
fourth	279 (50.2)	213 (51.7)
Race/ethnicity ^a		
non-Hispanic white	114 (20.5)	275 (66.8)
Hispanic	178 (32.0)	47 (11.4)
black	58 (10.4)	20 (4.8)
multirace/other ^b	134 (24.1)	61 (14.8)
unknown	72 (13.0)	9 (2.2)
Weight status ^c		
underweight	12 (2.2)	5 (1.2)
normal weight	285 (51.3)	268 (65.2)
overweight	106 (19.1)	79 (19.2)
obese	153 (27.5)	59 (14.4)
Total daily MVPA, mean (SD), min	41.7 (17.1)	49.0 (22.7)
O-MVPA, mean (SD), min	23.7 (13.3)	30.4 (17.2)
S-MVPA, mean (SD), min	18.0 (7.7)	18.6 (9.8)
High PAC	231 (44.6)	245 (61.7)

Abbreviations: BMI, body mass index; FLEX, Fueling Learning through Exercise; MVPA, moderate to vigorous physical activity; O-MVPA, out-of-school MVPA; PAC, perceived athletic competence; SES, socioeconomic status; S-MVPA, school-time MVPA.

^aDoes not add up to 100% because of missing data.

^bMultirace/other comprised of American Indian, Pacific Islander, and Asian.

^cDetermined by BMI z score and percentiles; underweight, <5th percentile; normal weight, 5th to <85th percentile; overweight, 85th to < 95th percentile; and obese, >95th percentile.

Table 2

Associations Between PAC, Total MVPA, O-MVPA, and S-MVPA by SES in Massachusetts Children ($N = 1054$)

	Low-SES children, β , 95% CI (P value)	Middle-SES children, β , 95% CI (P value)
Total MVPA model high PAC	-0.17, -2.54 to 2.19 (.885)	6.59, 3.86 to 9.32 (<.001)
O-MVPA model high PAC	-0.66, -2.49 to 1.17 (.48)	4.76, 2.76 to 6.75 (<.001)
S-MVPA model high PAC	0.40, -0.79 to 1.59 (.51)	1.80, 0.12 to 3.50 (.036)

Note. Covariates in analyses include sex, race, grade, eligibility for free/reduced price lunch, BMI category, accelerometer wear time, precipitation (yes/no), average daily high temperature, and clustering within schools; referent group = low PAC.

Abbreviations: BMI, body mass index; CI, confidence interval; MVPA, moderate to vigorous physical activity; O-MVPA, out-of-school MVPA; PAC, perceived athletic competence; SES, socioeconomic status; S-MVPA, school-time MVPA.

Table 3Top 10 Organized Sports/Activities Reported by Low-SES and Middle-SES Children ($n = 599$)

Sport/Activity	Reported N (%)
Soccer	197 (32.9)
Basketball	113 (18.9)
Football	69 (11.5)
Cheerleading/dance	63 (10.5)
Gymnastics	40 (6.7)
Baseball/softball	35 (5.8)
Hockey	28 (4.7)
Martial arts	23 (3.8)
Swimming	23 (3.8)
Tennis	10 (1.7)

Abbreviation: SES, socioeconomic status.