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Self-efficacy, not peer or parent support, is associated with more physical activity and less sedentary time among 8-12 year old youth with elevated body mass index

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Abstract

Background: Youth experience a decrease in physical activity (PA) and an increase in sedentary time during adolescence. Better understanding of factors associated with activity levels during pre-adolescence may inform interventions to minimize decline. This study compared the association of self-efficacy for PA, parent support for PA, and peer support for PA with moderate-to-vigorous physical activity (MVPA) and sedentary time among 8–12 year old children with body mass index (BMI) ≥ 75th percentile.

Methods: This study analyzed baseline data from a school-based healthy weight management intervention trial, conducted in metropolitan Minnesota. Self-efficacy for PA, parent support for PA, and peer support for PA were measured by child survey using reliable tools. MVPA and sedentary time were measured using accelerometer.

Results: Participants included 114 children; mean age was 9.4±0.9 years, 51% were female, 55% received public assistance, and 57% were racial/ethnic minorities. Self-efficacy for PA was positively associated with MVPA for girls (β=1.83, p<0.01) and inversely with sedentary time for

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the total sample (β= −7.00, p=0.03). Parent support for PA was positively associated with sedentary time for girls (β=9.89, p=0.04) and the total sample (β=7.83, p=0.04).

Conclusions: Interventions for pre-adolescents with elevated BMI may improve activity levels by increasing self-efficacy for PA.

Keywords

exercise; pre-adolescent; adolescent

Introduction

The greatest decline in youth activity levels occurs during adolescence,[1–4] suggesting that pre-adolescence may be a critical time for intervention. Better understanding of the individual and interpersonal factors associated with physical activity (PA) and sedentary time during pre-adolescence may inform interventions to minimize the decline.[5–10] Understanding these associations in pre-adolescents at risk for poor health outcomes, such as pre-adolescents with elevated body mass index (BMI), is especially important given the harmful health impact of physical inactivity and prolonged sedentary time.[11–14] However, existing research in this population is limited and has often relied on self-reported rather than objective measures of activity. Further, the simultaneous influence of intra- and interpersonal factors on activity levels in this population has not been widely studied.

The aim of this study was to simultaneously compare the association of self-efficacy for PA, parent support for PA, and peer support for PA with moderate-to-vigorous physical activity (MVPA) and sedentary time among 8–12 year old children with a BMI ≥ the 75th percentile. Children in the top quartile of the growth chart are at risk for excess weight gain during the preadolescent period and intervention at this time may promote a healthy body weight, making research focused on this population particularly important.[15–17]

Methods

This study was a secondary analysis of baseline data collected from June to August 2014–2018 as part of the Students, Nurses, and Parents Seeking Healthy Options Together (SNAPSHOT) study, a randomized controlled trial of an elementary school-based healthy weight management intervention set in the Minneapolis/St. Paul metropolitan area targeting 8–12 year old children. Eligibility criteria included child with BMI percentile ≥75 for age and sex, child and parent able to read, write, and speak English, child living with participating parent most of the time, and willingness to be randomized. Exclusion criteria included plans to move outside the school district within the next 12 months and child with food allergies, physical limitations or medical conditions that would limit ability to participate in physical activity, or emotional health conditions that would limit ability to participate in group activities. Participants were recruited using flyers, school and district website announcements, in-person presentations at school events, and general mailings. Intervention details are reported elsewhere.[18] Temple University and University of Minnesota Institutional Review Boards approved the study; all participants provided informed parent consent and child assent.

Measures

Participant demographic information was collected via parent survey. Height and weight were measured by trained study staff using standard procedures,[19] with BMI z-scores calculated using Centers for Disease Control and Prevention growth charts.[20]

A paper and pencil survey completed by the child included items that assessed self-efficacy for PA, parent support for PA, and peer support for PA. The 10-item Self-efficacy for Physical Activity Scale, adapted from a reliable tool,[21] included questions about how hard it would be to engage in behaviors related to PA (range 10–30; higher score indicates higher self-efficacy; $\alpha = 0.73$). Example items included "how hard would it be for you to be physical active most days after school?" or "how hard would it be for you to be physically active even if you feel tired?" with response options "not at all hard," "a little hard," and "very hard." "How hard would it be for you to be physically active outside, even when it is cold?" was added. The nine-item Parent Support for Physical Activity Scale, adapted from two reliable tools,[21,22] included questions about how often the child's parent engages in behavior to support PA (range 9–36; higher score indicates higher support; $\alpha = 0.73$). Respondents were asked "How often do your parents do the following things" with options of almost "never," "sometimes," and "always." Example items included "My parents give me a ride so I can go to a place where I can be physically active or play sports" and "My parents tell me that physical activity is good for my health." Two items were added: "My parents try a new physical activity with me" and "My parents take me to try a new physical activity." The seven-item Peer Support for Physical Activity Scale was adapted from the Parent Support for Physical Activity Scale; it mirrored the parent scale minus two parent-specific questions that related to transporting the child to physical activity (range 7–21; higher score indicates higher support; $\alpha = 0.79$).

Actigraph uniaxial GT3X+ accelerometer[23], validated for use in children,[24–26] was used to measure minutes of MVPA and sedentary time per day. Children were asked to wear the Actigraph on their right hip during all waking hours for a continuous seven-day period. Children were also instructed to remove the ActiGraph anytime it might get completely wet (e.g., shower, bath, swimming). ActiGraph data were collected in 15-second epochs and downloaded using the ActiLife software (ActiGraph, Pensacola, FL)[27] and processed using free, open-source computing language and packages in R.

The "PhysicalActivity" package from Choi et al.[28] was used to identify periods of non-wear time using the following parameters: 90-minute window frame, 30-minute up- and down-stream examination from current epoch for any activity, and a 2-minute allowance frame for activity within the up- or down-stream. At least 480 minutes of wear time per day were required to represent a day of data. Children supplying no days or only one day of ActiGraph data were dropped from the analyses (N=5). Children supplying two or three days of data (N=7) were subjected to further wear-time processing to minimize the loss of data.[29,30] For these children all days with ≥60 minutes of valid wear-time, including those days with at least 480 minutes of wear time, were used to estimate the participant's activity throughout a "representative" day. The representative day was derived by averaging the within-minute values across days using only periods that were labeled as wear-time. Children with at least four days of data were retained without further wear-time processing.

Following the wear-time processing, the Evenson et al.[31,32] cutpoints were applied to the 15-sec epoch data to determine minutes of sedentary behavior (≤ 25 counts/15sec) and light (26–573 counts/15sec), moderate (574–1002 counts/15sec), and vigorous (≥1003 counts/15sec) intensity physical activity.

Statistical Analyses

Participant demographic characteristics were summarized using descriptive statistics. Multivariate linear regression was used to compare self-efficacy for PA, parent support for PA, and peer support for PA as continuous independent variables. The dependent variable in model 1 was mean minutes of MVPA per day and in model 2 was mean minutes of sedentary time per day. Both models controlled for age (continuous), BMI z-score (continuous), socioeconomic status (receipt of public assistance yes/no), and race/ethnicity (member of racial/ethnic minority group yes/no) because they were associated with PA or sedentary time in our sample and/or prior research.[14,33–36] Model 1 controlled for mean minutes of light PA and sedentary time per day; model 2 controlled for mean minutes of light PA and MVPA per day. Models were first estimated for the total sample and then stratified by sex, based on well-established sex differences in physical activity levels.[4,7,37,38] SAS 9.4 was used for analyses.[39] A p-value of <0.05 was used to assess statistical significance.

Results

Table 1 describes sample demographics. Among youth (N=114), mean age was 9.4±0.9 years, 51% were female, 55% received public assistance, and 57% were members of racial/ethnic minority groups. Most had overweight (30%) or obesity (49%), with 18% having severe obesity. Youth engaged in a mean of approximately 40 minutes per day of MVPA and 8.3 hours per day of sedentary time with no significant sex differences. Self-efficacy for PA (23.1±3.8), parent support for PA (19.6±3.4), and peer support for PA (13.3±3.5) were at scales' approximate midpoints. Only parent support for PA differed by sex (19.0±3.8 for girls, 20.3±2.7 for boys, p= 0.04). Table 2 presents multivariate analyses results. Self-efficacy for PA was positively associated with MVPA for girls (β=1.83, p<0.01) and inversely associated with sedentary time for the total sample (β= −7.00, p=0.03). Parent support for PA was positively associated with sedentary time for the total sample (β=7.83, p=0.04) and for girls (β=9.89, p=0.04).

Discussion

This study is the first to identify that self-efficacy for PA, when considered simultaneously with parent and peer support for PA, is significantly associated with activity levels in 8–12 year old youth with a BMI ≥ 75th percentile. Self-efficacy for PA was positively associated with MVPA for girls and inversely associated with sedentary time for the total sample. These findings align with prior work demonstrating modest but consistent associations of self-efficacy with activity levels in older youth (e.g.,[40–43]). This study builds upon that knowledge by identifying factors associated with physical inactivity and sedentary time in pre-adolescent youth who are at risk of excess weight gain, which can inform future research and potential intervention targets. Given that 40% of pre-adolescent youth have a BMI ≥ 75th

percentile[16] (a prevalence that persists despite extensive obesity reduction efforts)[44–47] and that the prevalence of severe childhood obesity is increasing,[48] a better understanding of factors associated with health behaviors in this population is critical.

Our study findings support previous research demonstrating the positive association between youth self-efficacy for PA and activity levels.[5–7,43,49–52] Results also align with theories such as Social Cognitive Theory[53,54] and the Theory of Planned Behavior[55] that delineate the key influence of self-efficacy on health behavior. Self-efficacy for PA may be particularly influential for youth with low parent and peer support for PA,[5,56] though sample size limitations and the cross-sectional design preclude exploring this hypothesis using the current data. Our study suggests that self-efficacy remains a key factor for youth with elevated BMI and during pre-adolescence, a time of increasing autonomy from parents and growing sensitivity to peer approval. Considered collectively, study findings suggest a renewed focus on PA and sedentary time interventions for pre-adolescents that include theory-driven, evidence-based strategies to increase self-efficacy for PA. Such interventions might re-examine developmentally-appropriate strategies for this age group, including strategies that account for decreased dependence on parents and increased interest in peer groups as youth transition into adolescence.

The sex differences found in this study are of concern given that girls engage in less PA and more sedentary time throughout childhood, with sex disparities becoming more pronounced during adolescence.[4,7,37,38] Girls' reliance on intra-personal factors (e.g., self-efficacy) may be due to greater external barriers to being active, such as less organized sports participation, [57] more sport-related teasing, greater body image concerns,[58] and sex stereotypes.[59] Further, this study and others found that girls experience lower parent and peer support for PA than boys, which may necessitate greater self-efficacy.[8] It is possible that girls with overweight or obesity experience greater barriers to PA,[60] which merits further evaluation using both quantitative and qualitative approaches.

The association between higher parent support for PA and increased sedentary time was not expected. It is possible that parents of sedentary children are concerned about their child's lack of activity and thus try to support their child's PA. Further, this study used baseline data from a voluntary healthy weight intervention; parents who enrolled their children may differ from the general population in that they have a greater interest in supporting healthy habits in their children. Another possible explanation is that parent support for PA does not align with sedentary behavior because - while PA and sedentary behavior are related and often considered together - they remain distinct phenomena. The cross-sectional design of this exploratory study prevents further investigation using this data, such as by testing whether increase in parent support for PA leads to decrease in sedentary behavior over time and how different types of parent support for PA impact behavior, but it can be examined in future research. Considered broadly, this finding highlights the gaps in knowledge about multi-level influences on health behavior among pre-adolescents who are at risk for excess weight gain.

Strengths and Limitations

Study strengths include use of reliable psychosocial measures, measured height and weight, and objective MVPA and sedentary time measurement. The sample, although small, was diverse in race/ethnicity and socioeconomic status and included an understudied population - pre-adolescents in the top quartile of the growth chart and at risk for excess weight gain. Limitations include the cross-sectional design and lack of generalizability because participants were from one Midwestern metropolitan area and volunteered for a healthy weight management intervention.

Conclusions

Pre-adolescence is likely a key time for PA interventions given the decline in PA and increase in sedentary time that occurs during adolescence.[1–4] Study findings suggest that interventions targeting pre-adolescents' PA and sedentary time would benefit from further development of self-efficacy for PA, particularly for girls.

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Table 1

Sample demographics and characteristics, stratified by sex

Demographic Characteristic	Total sample (n=114)	Girls (n=58)	Boys (n=56)	P-value
Age in years (mean±SD)	9.4 (0.9)	9.4 (0.9)	9.3 (0.9)	0.29
Race/ethnicity (n [%])				
American Indian	1 (0.9)	1 (1.7)	0 (0)	
Asian or Pacific Islander	8 (7.0)	4 (6.9)	4 (7.1)	
Black/African American	21 (18.4)	14 (24.1)	7 (12.5)	
White	65 (57.0)	32 (55.2)	33 (58.9)	
>1 Race	12 (10.5)	6 (10.3)	6 (10.7)	
Other	7 (6.1)	1 (1.7)	6 (10.7)	0.23
Hispanic	25 (21.9)	10 (17.2)	15 (26.8)	
Not Hispanic	89 (78.1)	48 (82.3)	41 (73.2)	0.22
Member of racial/ethnic minority group[a]				
Yes	65 (57.0)	33 (56.9)	32 (57.1)	
No	49 (43.0)	25 (43.1)	24 (42.9)	0.98
Household receipt of public assistance (n [%])				
Yes	63 (55.3)	37 (63.8)	26 (46.4)	
No	51 (44.7)	21 (36.2)	30 (53.6)	0.06
BMI z-score (mean±SD)	1.6 (0.7)	1.6 (0.7)	1.6 (0.6)	0.74
Obesity (n [%])[b]				
Yes	56 (49.1)	28 (48.3)	28 (50.0)	
No	58 (50.9)	30 (51.7)	28 (50.0)	0.85
Minutes of light activity per day (mean±SD)	254.5 (89.8)	255.5 (78.3)	253.8 (101.0)	0.94
Minutes of MVPA per day (mean±SD)	39.2 (19.9)	35.8 (17.2)	42.7 (22.0)	0.07
Minutes of sedentary time per day (mean±SD)	497.9 (125.3)	508.1 (123.1)	487.3 (127.8)	0.39
Self-efficacy for PA[c] (mean±SD)	23.1 (3.8)	22.9 (3.4)	23.3 (4.2)	0.58
Parent support for PA[d] (mean±SD)	19.6 (3.4)	19.0 (3.8)	20.3 (2.7)	0.04
Peer support for PA[e] (mean±SD)	13.3 (3.5)	13.0 (3.6)	13.6 (3.4)	0.37

[a]Racial/ethnic minority defined as Black or African American, Asian or Pacific Islander, American Indian, more than one race, or Hispanic

[b]Obesity defined as BMI percentile ≥ 95

[c]Ten-item scale (score range 10–30; higher score indicates higher self-efficacy; $\alpha = 0.73$)

[d]Nine-item scale (score range 9–36; higher scores indicates higher support; $\alpha = 0.73$)

[e]Seven-item scale (score range 7–21; higher score indicates higher support; $\alpha = 0.79$)

Note: BMI = Body Mass Index; MVPA = Moderate-to-Vigorous Physical Activity; PA = Physical Activity

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Table 2

Associations between self-efficacy for PA, parent support for PA, and peer support for PA with minutes of MVPA and sedentary time per day, stratified by sex[a]

Domain	Total Sample (n=114)		Girls (n=58)		Boys (n=56)	
	β (95% CI)	P-value	β (95% CI)	P-value	β (95% CI)	P-value
Model 1: Minutes of MVPA Per Day						
Self-efficacy for PA[b]	0.82 (−0.20, 1.83)	0.69	1.83 (0.50, 3.16)	<0.01	0.21 (−1.26, 1.68)	0.78
Parent support for PA[c]	0.49 (−0.76, 1.75)	0.44	0.48 (−0.91, 1.87)	0.49	0.19 (−2.20, 2.58)	0.88
Peer support for PA[d]	0.08 (−1.11, 1.26)	0.90	−0.61 (−1.96, 0.75)	0.37	0.27 (−1.70, 2.24)	0.78
Model 2: Minutes of Sedentary Time Per Day						
Self-efficacy for PA[b]	−7.00 (−13.21, −0.80)	0.03	−5.64 (−15.71, 4.43)	0.27	−5.64 (−14.15, 2.87)	0.19
Parent support for PA[c]	7.83 (0.21, 15.44)	0.04	9.89 (0.38, 19.40)	0.04	−1.01 (−15.10, 13.07)	0.89
Peer support for PA[d]	−3.50 (−10.80, 3.80)	0.34	−4.46 (−14.10, 5.18)	0.36	−1.84 (−13.46, 9.76)	0.75

[a]Analyses controlled for age (continuous), BMI z-score (continuous), socioeconomic status (receipt of public assistance yes/no), and race/ethnicity (member of racial/ethnic minority group yes/no). Model 1 also controlled for mean minutes of light PA and sedentary time per day; model 2 also controlled for mean minutes of light PA and MVPA per day.

[b]Ten-item scale (score range 10–30; higher score indicates higher self-efficacy; α = 0.73)

[c]Nine-item scale (score range 9–36; higher scores indicates higher support; α = 0.73)

[d]Seven-item scale (score range 7–21; higher score indicates higher support; α = 0.79)

Note: MVPA = Moderate-to-Vigorous Physical Activity; PA = Physical Activity