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What matters when children play: Influence of Social Cognitive Theory and perceived environment on levels of physical activity among elementary-aged youth

Brook E. Harmon [a,*], Claudio R. Nigg [b], Camonia Long [a], Katie Amato [b], Anwar [b], Eve Kutchman [c], Peter Anthamatten [d], Raymond C. Browning [e], Lois Brink [c], James O. Hill [f]

[a] University of Hawaii Cancer Center, Cancer Epidemiology Program, 701 Ilalo Street, Honolulu, HI 96822, USA
[b] University of Hawaii, Office of Public Health Studies, Honolulu, HI 96822, USA
[c] University of Colorado Denver, College of Architecture and Planning, Denver, CO 80202, USA
[d] University of Colorado Denver, Department of Geography and Environmental Sciences, Denver, CO 80202, USA
[e] Colorado State University, College of Health and Human Sciences, Fort Collins, CO 80523, USA
[f] University of Colorado Denver, School of Medicine, Anschutz Health and Wellness Center, Aurora, CO 80045, USA

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ABSTRACT

Objectives: Social Cognitive Theory (SCT) has often been used as a guide to predict and modify physical activity (PA) behavior. We assessed the ability of commonly investigated SCT variables and perceived school environment variables to predict PA among elementary students. We also examined differences in influences between Hispanic and non-Hispanic students.
Design: This analysis used baseline data collected from eight schools who participated in a four-year study of a combined school-day curriculum and environmental intervention.
Methods: Data were collected from 393 students. A 3-step linear regression was used to measure associations between PA level, SCT variables (self-efficacy, social support, enjoyment), and perceived environment variables (schoolyard structures, condition, equipment/supervision). Logistic regression assessed associations between variables and whether students met PA recommendations.
Results: School and sex explained 6% of the moderate-to-vigorous PA models' variation. SCT variables explained an additional 15% of the models' variation, with much of the model's predictive ability coming from self-efficacy and social support. Sex was more strongly associated with PA level among Hispanic students, while self-efficacy was more strongly associated among non-Hispanic students. Perceived environment variables contributed little to the models.
Conclusions: Our findings add to the literature on the influences of PA among elementary-aged students. The differences seen in the influence of sex and self-efficacy among non-Hispanic and Hispanic students suggests these are areas where PA interventions could be tailored to improve efficacy. Additional research is needed to understand if different measures of perceived environment or perceptions at different ages may better predict PA.

Introduction

Physical activity (PA) among youth is associated with both immediate and long-term health benefits (Dwyer et al., 2009; Gordon-Larsen, Nelson, & Popkin, 2004). Participating in a combination of moderate and vigorous PA for 60 min per day reduces body adiposity, increases aerobic fitness, reduces blood pressure, and improves bone mass, among other health benefits (US Department of Health and Human Services, 2008). However, only

* Corresponding author. Tel.: +1 808 564 5866; fax: +1 808 586 2982.
E-mail addresses: bharmon@cc.hawaii.edu (B.E. Harmon), cnigg@hawaii.edu (C. R. Nigg), clong@hawaii.edu (C. Long), kamato@hawaii.edu (K. Amato), manwar@hawaii.edu (Anwar), eve.kutchman@ucdenver.edu (E. Kutchman), peter.anthamatten@ucdenver.edu (P. Anthamatten), ray.browning@ColoState.edu (R. C. Browning), lois.brink@ucdenver.edu (L. Brink), james.hill@ucdenver.edu (J. O. Hill).

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around 18% of youth meet national recommendations for aerobic activity (US Department of Health and Human Services, 2013). Moreover, the amount of time children engage in PA declines continuously from childhood to adolescence to adulthood (Pate et al., 2009), and the gap between time spent in PA and recommendations is larger among girls than boys (Nadar, Bradley, Houts, McRitchie, & O'Brien, 2008). Ethnic differences in the amount of time spent in PA may also emerge as children move into adolescence; however, the number of studies which have recruited elementary-aged youth from ethnic minority groups is limited (Gesell et al., 2008; van der Horst, Chin A. Paw, Twisk, & van Mechelen, 2007).

Schools provide the opportunity for cost effective and efficient delivery of PA instruction and programs due to the large number of children they reach, the amount of time children spend in school, and the potential for PA equipment to be present in schoolyards. PA at school may be especially important for minority children living in low-income, urban areas where PA opportunities and facilities are often limited (Umstattd Meyer, Sharkey, Patterson, & Dean, 2013; Wright, Giger, Norris, & Suro, 2013). Children may engage in moderate or vigorous PA at various times throughout the school day, including during recess, physical education classes, lunch, and regular classroom time (Nettleford, McKay, Warburton, McGuire, & Bredin, 2010; Tudor-Locke, Lee, Morgan, Beighle, & Pangrazi, 2006). Due to academic demands, opportunities for PA during the school day in the form of physical education classes may be reduced (Slater, Nicholson, Chriqui, Turner, & Chaloupka, 2012); however, after-school programs provide students with access to school facilities and have been shown to promote increased PA among youth (Branscum & Sharma, 2012; Iversen, Nigg, & Titchenal, 2011; Tudor-Locke et al., 2006). Previous work has observed that girls spend less time engaged in PA than boys both during and after school (Nettleford et al., 2010; Ridgers, Saint-Maurice, Welk, Siahpush, & Huberty, 2011), and some ethnic differences may also exist (Ridgers et al., 2011).

Social Cognitive Theory (SCT) is frequently used as a theoretical framework in school-based interventions (Branscum & Sharma, 2012; Brown, Hume, Pearson, & Salmon, 2013; Sharma, 2006). SCT offers a comprehensive framework for understanding PA behavior among youth at school as it addresses individual, environmental, and social constructs, as well as the dynamic interaction between person, environment, and behavior (Bandura, 1986, 2004). Studies of school and after-school PA programs have shown that self-efficacy, enjoyment, and social support are predictors of PA (Branscum & Sharma, 2012; Brown et al., 2013). While much work exists to link children's perceptions of their neighborhood and other environments with PA behavior (Holt, Spence, Sehn, & Cutumisu, 2008; Hume, Salmon, & Ball, 2005), additional work is needed to explore the behavioral impacts of children's perceptions of the physical environment in their schools (Brown et al., 2013), and little is known about how psychosocial and perceived environment variables may differ among ethnic minority populations (van der Horst et al., 2007).

The primary aims of this study were to examine 1) the relationship between SCT variables (self-efficacy, enjoyment, and social support) and PA levels among elementary school children; 2) to examine perceived PA environment variables related to schoolyards (structures, condition, equipment and supervision) and their ability to predict PA above and beyond the other SCT variables; and 3) to examine if ethnicity moderates this relationship. Due to the large Hispanic population in our dataset, we specifically examined differences in PA levels and predictors of PA between Hispanic and non-Hispanic students.

Methods

Procedure and participants

The current study sampled participants of the [blinded] study, a four-year project examining the effects of a combined curriculum and environmental intervention on children's PA during the school day. It builds on previous work to examine the influence of renovating schoolyards on PA (Anthamatten et al., 2011; Brink et al., 2010). Eight urban public schools located in Denver, Colorado were recruited to participate in the study. Schools were located in predominately low-income neighborhoods with large ethnic minority populations. Recruitment occurred April through May of 2010 and 2011. Baseline data were collected at four schools in cohort one (2010) and another four schools in cohort two (2011). Additional data were collected in school years 2011–2012 and 2012–2013. The study protocol was approved by the [blinded] Committee on Human Subjects and the [blinded] Institutional Review Board.

For this analysis, baseline questionnaire data were used. Data were collected from two randomly selected classrooms of 4th and 5th ($n = 393$) graders at the eight schools. Recruitment in these classrooms consisted of giving students in the selected classes consent forms and a parent letter explaining the study two weeks before the measurement visit. For the two weeks, teachers and study staff reminded students verbally and with parent reminder letters to return consent forms to their teacher by the measurement day. Study staff members were also available to answer any consent questions. A total of 866 students were notified of the study.

Surveys from all classes and schools were collected during a six-week window in the spring on a pre-determined measurement day. Each teacher scheduled a 45-min block of time on this day for study staff to administer the survey in the classroom and, the day prior to measurement, provided a list of all consented students to the study coordinator. On measurement day, the study staff arrived at the school 45 min prior to the scheduled start time of the survey to answer any last minute questions, assign missing study ID numbers, and to set up for survey administration. Each class participated separately with a minimum of four study staff present in each classroom during survey administration. Students whose parents did not give consent to participate remained in the classroom and were given other activities to complete by their teacher. Assent was then obtained from the consented students and study staff placed study ID numbers on both the assent and consent forms. Once this was completed, the surveys were distributed to the students, along with a pencil and eraser, and the final ID sticker was placed on the survey. Students were instructed not to put their name on the survey in order to maintain confidentiality.

Students were advised this was a not a test—but rather a survey—and that there are no right or wrong answers. They were asked to give their honest opinions and not to copy answers from other students or say their answers out loud. Students were told they could raise their hands to ask questions, which would be answered individually. One research assistant read the survey out loud while three other study staff roamed the room to be available for any specific questions or to assist any students who did not understand the survey. Students were encouraged to stay on pace with the reader, but were allowed to quietly work ahead. Research assistants were also available to translate into Spanish when necessary. Once the students were finished with the survey, research assistants collected the surveys and moved on to the next scheduled classroom. The study coordinator kept completed surveys in a secure box until they were returned to the study office. Students whose parents gave consent but were absent on the survey day were allowed to take the survey within one week of the measurement day and were

given the survey by their teacher. Late surveys were retrieved when the study staff returned to the school to pick up other study materials. The overall response rate for survey completion was 45%, but rates varied by school (ranging from 5 to 91%).

Measures

Individual characteristics

Participants self-reported their height, weight, sex, ethnicity, and age. Self-reported height and weight was used to estimate body mass index (BMI) percentile for age. Studies on the validity and reliability of self-reported height and weight among children indicate a tendency towards overestimation of height and underestimation of weight (Seghers & Claessens, 2012; Tsigilis, 2006). A previous comparison of self-report compared to measured data from [blinded] participants found that weight was estimated more accurately than height, older students (5th versus 1st graders) were better able to estimate both measurements, and underestimation of weight occurred more often as BMI increased (Beck et al., 2012). Despite variations within this population, patterns of self-reported height and weight were similar to those in adult populations (Beck et al., 2012).

Physical activity level

Participants' PA was assessed using an adaptation of Godin and Shephard's Leisure-Time Exercise Questionnaire (Godin, Jobin, & Bouillon, 1986; Godin & Shephard, 1985). This questionnaire was selected for its ease of use in assessing PA among a large group of elementary children, has been validated with 5th grade students and used in previous PA intervention studies with elementary students (Battista, Nigg, Chang, Yamashita, & Chung, 2005; Sallis, Buono, Roby, Micale, & Nelson, 1993). Students were asked to indicate how many days per week and how many minutes per day during an average week they engaged in strenuous, moderate, and mild PA during their free time. Vigorous PA was defined as: heart beats rapidly, sweating; for example, running, jogging, vigorous swimming, vigorous bicycling, and vigorous aerobic dance classes. Moderate PA was defined as: not exhausting, light sweating; for example, fast walking, baseball, easy bicycling, and volleyball. Mild PA was defined as: minimal effort, no sweating; for example, easy walking, yoga, and playing horseshoes. Students' responses for the vigorous and moderate PA variables were summed and then used to determine whether each student met the guideline of 60 min per day of moderate-to-vigorous PA (MVPA) (US Department of Health and Human Services, 2008).

Theoretical variables

Self-efficacy

The Shortened PA Self-Efficacy Scale was used to measure students' confidence in their ability to participate in regular PA when barriers were present (Benisovich, Rossi, Norman, & Nigg, 1998). Scores represented an average of six items that assessed barriers such as rain, stress, and being short on time. Scores were generated by averaging each participant's response, with a higher score indicating greater confidence in participating in PA when faced with barriers. Possible scores ranged from 1 to 5. The original 18-item PA Self-Efficacy Scale has established reliability (0.77–0.87 depending on subscale) (Benisovich et al., 1998). The shortened scale had a coefficient alpha of 0.54 when used to assess PA self-efficacy in a study of students in grades 4–6 who participated in a physical activity and nutrition after-school program (Battista et al., 2005).

Enjoyment

A modified version of the Shortened Physical Activity Enjoyment scale (S-PACES) was used to measure students' feelings about being active (Dishman et al., 2005). Scores represented an average of five positively worded items that asked students to complete stems such as "When I am active…" with options such as "I enjoy it," and "My body feels good." Scores, ranged from 1 to 5, and were generated by averaging each participant's responses, with a higher score indicating greater participant enjoyment of PA. The validity of this instrument was established in previous work with 6th and 8th grade girls (Dishman et al., 2005).

Social support

Items related to social environment on the Perceived Physical Activity Environment Scale were used to measure students' beliefs related to social support (Hume, Ball, & Salmon, 2006). Original items only measured social support at home and neighborhood. Items were adapted and added to assess social support at school. Two home items were used (e.g., encouragement to play from family), three neighborhood items (e.g., having friends who like to play outside), and three school items (e.g., having friends at school to play with, encouragement to play from teachers). These items employed a dichotomous response choice (yes/no). Potential scores ranged from 0 to 8, with a higher score indicating higher social support for PA. The Perceived Physical Activity Environment Scale is internally consistent and all items showed good agreement (>68%) between test and retest (Hume et al., 2006).

Structures

The presence of structures and play areas was assessed with 14 items from the adapted version of the Perceived Physical Activity Environment Scale (Hume et al., 2006). Items asked students about the presence of PA structures such as basketball hoops, swings, and open fields. In adapting the questionnaire, face validity was established with a review of the study's schoolyard maps to insure all structures present were included in the scale. Questions were rated as present or not present (yes/no). A higher score indicated that many items are available at the participant's school. The possible score range was 0–14.

Condition

The condition of structures and play areas was assessed with 14 follow-up items from the adapted version of the Perceived Physical Activity Environment Scale (Hume et al., 2006). These items assessed students' perceptions of the condition of structures (e.g., open fields, jungle gyms, four square) by asking participants "What is the condition of the equipment in your school." Scores on all items were averaged to measure perceptions of the overall condition of the school's built environment. The resulting score had a range of 1–5, with a 1 indicating equipment in very poor condition and 5 indicating equipment in very good condition.

Equipment and supervision

The study team developed five items to assess students' perceptions of their access to moveable equipment and exposure to adult-supervised activities. These questions were designed to assess how often their school provided adult supervision during recess/lunch and after school, how often equipment was provided during recess/lunch and after school, and whether the school play areas were accessible after school and on weekends. Questions were modeled after those on the Perceived Physical Activity Environment Scale and were reviewed for face validity by two experts in the field of children's PA (questions presented in supplementary materials). All five items are rated on a five-point Likert Scale that included a response option of "Don't know," which was recorded as

Table 1
Descriptive statistics for participant, predictor, and outcome variables.

n	Range across schools	All students	Hispanic	Non-Hispanic
	6–79	393	216	157
Participant variables	**Mean (SD)**			
Age	9.83–10.37	10.25 (0.76)	10.26 (0.75)	10.24 (0.75)
BMI percentile for age	47.97–72.07	62.89 (33.57)	67.09 (33.08)	58.15[a] (32.71)
	Number (%)			
Race				
Hispanic	6–46	216 (58%)	–	–
White	0–40	105 (28%)	–	–
Black	0–7	19 (5%)	–	–
Other	0–14	33 (9%)	–	–
Sex				
Boys	4–53	194 (50%)	95 (44%)	92 (59%)
Girls	2–41	197 (50%)	121 (56%)	64[a] (41%)
Predictor and outcome variables	**Mean (SD)**			
SCT variables				
Self-efficacy	3.04–4.06	3.28 (0.80)	3.28 (0.82)	3.32 (0.76)
Enjoyment	4.20–4.97	4.35 (0.70)	4.42 (0.62)	4.24[a] (0.80)
Social support	6.00–6.41	6.22 (1.54)	6.39 (1.47)	5.99[a] (1.60)
Perceived environment variables				
Structures	7.20–13.17	9.95 (2.43)	9.91 (2.33)	10.06 (2.60)
Condition	3.53–4.31	3.73 (0.65)	3.74 (0.65)	3.73 (0.64)
Equipment & supervision	3.21–3.95	3.42 (0.73)	3.46 (0.78)	3.34 (0.64)
Physical activity level				
MVPA (minutes per day)	40.86–62.71	54.95 (31.89)	54.74 (32.34)	55.28 (30.95)
Strenuous (minutes per day)	23.05–36.43	32.23 (19.07)	32.25 (18.83)	32.38 (19.32)
Moderate (minutes per day)	16.24–29.39	23.05 (18.37)	22.85 (18.30)	23.25 (18.29)
Mild (minutes per day)	15.17–27.26	20.82 (19.37)	19.24 (18.39)	22.82 (20.27)
MVPA recommendation	**Number (%)**			
<60 min per day	4–47	223 (56.7%)	122 (56.5%)	90 (57.3%)
60 + minutes per day	2–37	169 (43%)	94 (43.5%)	67 (42.7%)

SD = Standard Deviation, BMI = Body Mass Index, MVPA = Moderate to Vigorous Physical Activity.
SCT = Social Cognitive Theory.
[a] Indicate significant differences between Hispanic and non-Hispanic students at $p \leq .05$ (*independent t-tests* used for continuous variables and *chi-square* for categorical variables).

missing. All of the participants' responses were averaged together, resulting in one score per participant, ranging from zero to four.

Analysis

Descriptive statistics were produced for age, ethnicity, sex, BMI percentile for age, and predictor and outcome variables. Statistics were produced for all students, students stratified by ethnicity (Hispanic or non-Hispanic), and the range across schools. Independent *t*-tests were used to assess differences between Hispanic and non-Hispanic students for descriptive continuous variables and chi-square tests to assess differences in descriptive categorical variables. Since participants were recruited from eight different schools, an ANOVA was used to assess if significant difference occurred in PA levels by school and should thus be controlled for in the analysis. As PA level differed by school, each of the eight schools were modeled as a categorical variable (e.g., school 5 or not, school 12 or not). Each categorical school variable was included by itself in a model for each PA level to determine which schools differed significantly in PA level in comparison to the other schools. Schools that differed significantly in these models were included in the full models, using the categorical variable. Correlations between all variables of interest were also assessed (data presented in supplementary materials).

A three-step linear regression was used to examine the ability of demographic, SCT (self-efficacy, PA enjoyment, social support) and perceived environment (structures, condition, equipment and supervision) variables to predict time spent at all PA levels. Covariates were entered into step one, SCT variables into step two, and perceived environment variables into step three. Age, sex, ethnicity, BMI percentile for age, and school were assessed for statistical significance and were included in each PA level model as covariates if significant at $p < .05$. Missing data were minimal and deleted pairwise during analysis. Following analysis of all students, data were stratified by ethnicity (Hispanic versus Non-Hispanic) using the same analytical process. A *p*-value of $\leq .05$ was used as the criterion for significance.

Logistic regression was also used to examine whether covariates and predictor variables influenced the likelihood that students met MVPA recommendations. MVPA, defined as meeting the 60-min per day threshold, was set as a categorical variable. A chi-square test was used to assess if school was associated with meeting MVPA recommendations. The association was not significant ($\chi^2 = 6.8$, $p = .45$) so school was not included in this analysis. Odds ratios and 95% confidence intervals were produced to assess the impact of variables on the likelihood that all students would meet the current MVPA recommendation as well as when students were stratified by ethnicity. All analysis was conducted using SPSS (version 20).

Results

A summary of individual characteristics is provided in Table 1. Students ranged in age from 9 to 12 years old, the largest ethnic

group represented was Hispanic (56%), half were girls, and the mean BMI percentile for age was 62.89 ($SD = 33.57$), which corresponds with the healthy weight category (Centers for Disease Control and Prevention, 2011). There were significantly more Hispanic girls than non-Hispanic girls in the sample ($\chi^2 = 8.15$, $p = .004$). Hispanic students also had higher mean BMI percentile for age when compared with non-Hispanic students ($t = -2.25$, $p = .03$).

Overall, students reported mid-level confidence (self-efficacy mean = 3.28, $SD = 0.80$), high PA enjoyment ($M = 4.25$, $SD = 0.70$), and high social support ($M = 6.22$, $SD = 1.54$). Students also reported a high number of structures ($M = 9.95$, $SD = 2.43$) that were in fair to good condition ($M = 3.73$, $SD = 0.65$), and "often" to "always" having equipment or supervision for PA ($M = 3.42$, $SD = 0.73$). Based on PA minutes reported, students spent more time in strenuous PA ($M = 32$ min/day, $SD = 18.37$) compared with moderate ($M = 23$ min/day, $SD = 19.37$) and mild ($M = 21$ min/day, $SD = 19.37$) PA; however, over half of the students (57%) did not meet the MVPA recommendation. Skewness and kurtosis indices were examined and normality assumptions were not violated. Hispanic students had higher PA enjoyment ($t = -2.45$, $p = .02$) and social support scores ($t = -2.44$, $p = .02$), but there was statistically

Table 2
Predictive ability of outcome variables for all students and stratified by ethnicity.

	All students				Hispanic ($N = 216$)				Non-Hispanic ($N = 157$)			
	β	B	R^2	ΔR^2	β	B	R^2	ΔR^2	β	B	R^2	ΔR^2
MVPA (min/day)												
Covariates[a]			0.06[b]				0.08[b]				0.04[e]	
Sex	−0.18	−11.62[b]			−0.21	−13.37[d]			−0.16	−10.27[d]		
School 1	−0.07	−6.04			−0.07	−6.75			−0.03	−2.49		
School 5	0.12	11.95[c]			0.10	8.46			0.12	17.80[e]		
SCT variables				0.15[b]				0.13[b]				0.25[b]
Self-efficacy	0.21	8.39[b]			0.15	6.07[d]			0.30	12.39[b]		
Enjoyment	0.14	6.22[c]			0.10	5.21			0.16	6.00[e]		
Social support	0.20	4.18[b]			0.23	5.11[b]			0.27	5.13[b]		
Perceived environment variables				0.02[d]				0.01				0.02
Structures	0.08	1.03[e]			0.09	1.23			0.05	0.58		
Condition	−0.08	−3.93[e]			−0.07	−3.40			−0.11	−5.07		
Equipment & supervision	0.08	3.50[e]			0.07	2.88			0.10	4.73		
Strenuous physical activity (min/day)												
Covariates[a]			0.05[b]				0.07[b]				0.04[d]	
Sex	−0.20	−7.43[b]			−0.22	−8.30[b]			−0.19	−7.28		
School 5	0.12	6.99[c]			0.09	4.62			0.12	11.31		
SCT variables				0.17[b]				0.15[b]				0.24[b]
Self-efficacy	0.22	5.28[b]			0.16	3.60[d]			0.31	7.95[b]		
Enjoyment	0.13	3.51[c]			0.14	4.38[d]			0.10	2.39		
Social support	0.20	2.51[b]			0.21	2.73[b]			0.27	3.28[b]		
Perceived environment variables				0.01				0.01				0.01
Structures	0.05	0.37			0.08	0.62			−0.04	−0.27		
Condition	−0.02	−0.47			0.00	−0.07			−0.03	−0.82		
Equipment & supervision	0.08	2.06			0.05	1.23			0.11	3.33[e]		
Moderate physical activity (min/day)												
Covariates[a]			0.05[b]				0.07[c]				0.04[e]	
Sex	−0.14	−4.98[c]			−0.15	−5.58[d]			−0.11	−4.06		
School 1	−0.09	−4.64[e]			−0.10	−4.90			−0.08	−4.52		
School 5	0.13	7.24[c]			0.12	5.87[e]			**0.13**	**11.34**[e]		
SCT variables				0.07[b]				0.07[b]				0.11[b]
Self-efficacy	0.13	2.98[c]			0.12	2.76[e]			0.16	3.87[e]		
Enjoyment	0.13	3.35[d]			0.05	1.44			0.19	4.24[d]		
Social support	0.13	1.56[c]			0.18	2.18[c]			0.16	1.81[e]		
Perceived environment variables				0.02[d]				0.02				0.03
Structures	0.08	0.63			0.07	0.57			0.11	0.76		
Condition	−0.11	−3.15[d]			−0.11	−2.98			−0.15	−4.20[e]		
Equipment & supervision	0.06	1.46			0.08	1.76			0.04	1.16		
Mild physical activity (min/day)												
Covariates			0.04				0.00				0.07[b]	
Ethnicity	−0.20	−7.98[b]			–	–			–	–		
School 12	−0.23	−11.08[b]			−0.08	−5.58			−0.30	−12.51[c]		
SCT variables				0.04[b]				0.03[e]				0.09[c]
Self-efficacy	0.08	1.88			−0.01	−0.18			0.20	5.31[d]		
Enjoyment	0.18	4.93[c]			0.19	5.50[d]			0.15	3.80		
Social support	0.01	0.14			0.00	0.05			0.09	1.12		
Perceived environment variables				0.01				0.02				0.01
Structures	−0.07	−0.52			−0.09	−0.74			−0.06	−0.44		
Condition	−0.06	−1.86			−0.05	−1.36			−0.08	−2.63		
Equipment & supervision	0.08	2.14			0.10	2.24			0.07	2.15		

[a] Age, body mass index (BMI) percentile for age, ethnicity (in All Student analysis), sex, and significant schools were all assessed as covariates. The variables listed were significant for each model.
[b] $p \leq .001$, [c] $p \leq .01$, [d] $p \leq .05$, [e] $p \leq .1$.

little difference between Hispanic and non-Hispanic students in relation to the outcome variables.

The range in variables across the eight schools is also presented in Table 1. There was variation across schools in the number of students recruited as well as the demographic, predictor, and outcome variables. Generally, PA and SCT variables were significantly correlated with stronger correlations between the variables and higher intensity PA (see Supplementary material).

Table 2 presents findings from the linear regression analysis. Sex was the only consistently statistically significant covariate across all models, and ethnicity was statistically significant in the mild PA model only. An ANOVA revealed statistically significant differences in PA across schools ($p = .008$ for MVPA, $p = .07$ for strenuous PA, $p = .005$ for moderate PA, $p = .05$ for mild PA). When the school variables were entered into the linear regression models as categorical variables, only three schools showed significant influence (School 1 for MVPA and moderate PA, School 5 for MVPA, strenuous and moderate PA, and School 12 for mild PA).

Across models, SCT variables were more predictive of PA than perceived environment variables and the strength of the contribution decreased with PA intensity. When MVPA was assessed, SCT variables explained an additional 15% ($p < .001$) of the variance in the model while perceived environment only added an additional 2% to the model ($p = .05$). A similar trend was observed with strenuous and moderate PA models; however, the contribution of perceived environment was not statistically significant for strenuous PA. SCT variables explained less variation (7%, $p < .001$) in the moderate PA model. Self-efficacy and social support contributed the most in both the MVPA and strenuous models ($\beta = 0.21$, $\beta = 0.22$ for self-efficacy and $\beta = 0.20$ for social support in the two models respectively). Among the perceived environment variables, contributions of each variable were the same in the MVPA model. In the moderate PA model, condition contributed the most ($\beta = -0.11$). Only SCT variables contributed to the mild PA model ($R^2 = 0.04$, $p = .001$) with enjoyment being the primary factor ($\beta = 0.18$).

The predictive contribution of covariates, SCT variables, and perceived environment variables differed by ethnicity across the PA levels (Table 2). The contribution of sex to the models was higher for Hispanic students than non-Hispanic students. SCT variables added less to the models for Hispanic students than for non-Hispanic students, although it decreased with decreasing PA intensity in both groups. Self-efficacy contributed less in the Hispanic group than the non-Hispanic group for all models, but especially in predicting MVPA ($\beta = 0.15$ versus 0.30) and strenuous PA ($\beta = 0.16$ versus 0.31). The perceived environment variables did not add explanatory power to the models in either ethnic group.

Sex was the only statistically significant covariate for the logistic regression models that included all students and Hispanic students (data presented in Supplementary materials). BMI percentile was initially significant and was included in the model for non-Hispanic students; however, it was not significant once the SCT and perceived environment variables were added. Patterns were similar to MVPA modeled as a continuous variable, in that the SCT variables were more influential than the perceived environment variables. Among all students, boys were more likely to meet the MVPA recommendation (OR = 2.08, 95% CI = 1.32–3.29). Students with higher enjoyment scores were also more likely to meet the MVPA recommendation (OR = 1.77, 95% CI = 1.19–2.64) as well as ones with higher self-efficacy scores (OR = 1.72, 95% CI = 1.27–2.34). Only one perceived environment variable bore a statistically significant association; students with higher equipment and supervision scores were more likely to meet the MVPA recommendation (OR = 1.50, 95% CI = 1.09–2.07). When stratified by ethnicity, only self-efficacy was associated with meeting the MVPA recommendation among Hispanic students (OR = 1.61, 95% CI = 1.07–2.42). Except for sex, there were no statistically significant associations among the covariates in the models of non-Hispanic students.

Discussion

The primary aim of this research was to examine the relationship between SCT and PA levels among elementary school children, with particular attention to the ability of perceived environment variables to predict PA above and beyond other SCT variables. Secondarily, we were interested in whether there were differences in predicting PA among Hispanic and non-Hispanic students. While previous studies examined SCT and perceived environment, very few have sought to understand the ability of these factors to explain PA among young children and Hispanic students. Overall, participants in our study reported high levels of strenuous PA, but most did not get 60 min or more of MVPA. Students rated in the middle or higher for SCT variables and had generally positive perceptions of their school environment. There was some variability in these factors based on ethnicity and school. These findings provide insight into influencers of PA among both Hispanic and non-Hispanic elementary students.

In the linear regression analysis, sex, school, self-efficacy, and social support explained most of the variation in the MVPA and strenuous PA models. This finding reinforces previous findings about the importance of sex and SCT variables in predicting children's physical activity (van der Horst et al., 2007; Rosenkranz, Welk, Hastmann, & Dzewaltowski, 2011). While previous work has looked at specific types of social support (e.g., classmate, peer, family) (Bean, Miller, Mazzeo, & Fries, 2012; Brown et al., 2013; Martin, McCaughtry, Flory, Murphy, & Wisdom, 2011), our measure used a global definition of social support that included family, neighborhood friends, and school friends. While some subsets of a child's support system may be more influential than others, our findings suggest children who feel supported in multiple settings are more likely to engage in more strenuous types of PA. This suggests that future interventions to increase PA should use a multi-targeted approach to increase social support for PA among a range of influencers (e.g., parents, friends, classmates, and teachers).

Social support was important among both Hispanic and non-Hispanic students when data were stratified by ethnicity, however, there were differences in the role of sex and self-efficacy. Among Hispanic students, sex was more relevant both in the models predicting PA level and in the analysis for meeting the MVPA guideline. While boys were more likely to be active at higher intensity levels than girls, Hispanic boys were particularly more likely to participate in moderate and strenuous PA than Hispanic girls. Past research has repeatedly shown girls are less likely than boys to be physically active, especially with increasing age (van der Horst et al., 2007; Sallis et al., 2001; Sallis, Prochaska, & Taylor, 2000). As interventions targeting girls are developed, especially if they are intended to reach ethnic minority groups, tailoring programs to meet their specific needs is important.

Our findings were mixed with respect to the influence of self-efficacy on PA among Hispanic students compared to non-Hispanic students. Hispanic students with high self-efficacy were more likely to meet the MVPA recommendation than Hispanic students with lower self-efficacy. However, our analysis also indicated self-efficacy had a lower predictive ability in the MVPA, strenuous, and moderate PA models among Hispanic students compared to non-Hispanic students. A previous study of overweight Hispanic children found social influences, but not self-

efficacy, to be associated with PA (Gesell et al., 2008). Improving our understanding of the role of social support and self-efficacy in PA behavior among Hispanic children is an important next step for research and interventions designed to increase PA among ethnic minority children.

While perceived environment and environment assessment are growing areas of interest within research on PA behavior, little work has examined the influence of perceptions related to the school environment on children's PA (Ferreira et al., 2007). Assessment of perceived environment has primarily focused on home and neighborhood environments or has examined PA among older age groups, such as adolescents (Davison & Lawson, 2006; Reis, Voorhees, Gittelsohn, Roche, & Astone, 2008), while assessments of the influence of school environments on PA have been primarily observational (Anthamatten et al., 2011, 2013; Brink et al., 2010; Brown et al., 2013; Sallis et al., 2001). In our study, perceived environment contributed only a small percentage to the models for MVPA and moderate PA. A previous study found a significant association ($\beta = 0.14$) between perceived school environment and PA among high school students (Fein, Plotnikoff, Wild, & Spence, 2004), perhaps suggesting perceptions of school environment may become more important in influencing PA with age. A population with greater variability in perceptions of the school environment may also yield different results, as the students in our study had generally positive perceptions of their school environments. The condition of structures was not related to PA levels in this analysis. Aesthetics have been noted as an important component of the environment in promoting PA (Anthamatten et al., 2011; Dunton, Kaplan, Wolch, Jerrett, & Reynolds, 2009; Sallis et al., 2001). Future research should look more closely at this relationship to consider potential modifying factors and evaluate whether different scales are needed to assess children's perceptions of their school environment.

Limitations of this study include the range in sample size from each school. Efforts were made to recruit all students in the randomly selected classrooms; however, variation in teacher and parent support led to differing sample sizes. Unfortunately, data on how participants who participated differed from non-responders are not available. We also used an adapted scale to assess perceived environment. The adaptation of this scale for the school environment may have missed important variables in this population and consequently limited the findings. We also used self-report data to assess our outcome of minutes of PA. While the instrument selected has a history of use in assessing elementary-aged youth's PA, studies using objective measures such as pedometers or accelerometers are needed to provide a more objective measure.

Conclusions

Our results demonstrate the importance of SCT variables, especially self-efficacy and social support, in understanding children's PA. Our analysis also highlights the importance of understanding how predictors of PA may differ by ethnic group. Future research should clarify issues related to self-efficacy's influence on PA, especially among ethnic minority populations, and the role of perceived school environment in influencing PA.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.psychsport.2014.02.001.

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