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## School influences on the physical activity of African-American, Latino, and white girls

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### Abstract

**BACKGROUND**—The purpose of this research was to examine the impact of school-related variables on the physical activity (PA) levels of early adolescent African-American, Latino, and white girls.

**METHODS**—Data were from 353 African-American (N = 123), Latino (N = 118), and white (N = 112) girls. PA levels included a PA latent factor and minutes per day of moderate-to-vigorous PA (MVPA). School variables included hours of physical education (PE), PE enjoyment, school physical environment, recess activity, and active transport to/from school. Multiple-group structural equation modeling examined relations between school variables and PA across ethnic groups.

**RESULTS**—Hours of PE were positively related to higher PA factor scores. Active transport was related to higher PA factor scores for white girls only, and to greater MVPA for African-American girls only. Hours of PE were related to PE enjoyment and the school physical environment for some ethnic groups. PE enjoyment was related to more recess activity among African-American and Latino girls, and PE enjoyment was associated with more active transport to school for all girls.

**CONCLUSIONS**—PE participation and active transport significantly contribute to girls' levels of PA, with differences across ethnic groups.

### Keywords

Girls; ethnicity; accelerometer; active transport; physical education

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Current recommendations are that school-aged youth should participate in 60 minutes or more of moderate to vigorous physical activity (PA) per day.<sup>1–3</sup> However, many children do

not meet PA recommendations.<sup>4</sup> In addition, PA typically declines during adolescence,<sup>5–7</sup> which makes the period from late elementary school through the early middle school years of particular interest. This time is also a period of adolescence in which PA participation has been somewhat underexplored<sup>8</sup>—especially among subgroups at high risk for obesity and lower levels of PA, namely, girls and minorities.<sup>8,9</sup> Whitt-Glover, Taylor, Health, and Macera<sup>9</sup> advocated for an increase in studies examining influences on PA for specific ethnic groups and sexes. They argue that such foci and analyses could help provide a better understanding of PA participation patterns within population subgroups, which could help researchers and practitioners target public health efforts to increase PA levels.<sup>9</sup>

Researchers have become increasingly interested in the impact of different environments on children's PA,<sup>10</sup> including the school environment.<sup>11</sup> Because children and adolescents spend many hours at school each day, researchers have argued that school time presents an important window of opportunity to influence PA participation levels.<sup>10,12</sup> Schools have the potential to influence PA through the provision of facilities and programs, P.E. participation, recesses, classroom PA breaks, and instruction from trained educators.<sup>13–16</sup> Unfortunately, in recent decades schools have substantially reduced opportunities for children to be physically active by shortening or eliminating P.E. classes, recesses, and extramural and extracurricular sports activities.<sup>17</sup> In addition, decreases in active transport to and from school are believed to contribute to decreases in youth's overall levels of PA and rising obesity levels.<sup>18</sup> Few studies have examined relations between school-related variables and PA levels with subgroups of ethnically diverse girls.

## School-related Influences

### Hours of physical education (PE) and enjoyment of PE

In recent decades, there has been a trend toward less PE in schools.<sup>10</sup> Chaloupka and Johnson<sup>12</sup> documented a significant drop in PE requirements between 8th and 12th grade. PE participation in elementary and middle schools also has dropped significantly in many states. Among middle school students (grades 6–8), McKenzie, Marshall, Sallis, and Conway<sup>19</sup> found that daily PE contributed a weekly total of 25 minutes of vigorous activity and 83 minutes of moderate-to-vigorous activity (MVPA). Although considerably lower than national objectives of at least 60 minutes of MVPA per day, these results demonstrate that PE participation may play a role in contributing minutes of MVPA to children's overall weekly levels of PA.

The amount of PE is important, but the quality of the PE experience also must be considered.<sup>10</sup> Classes should be developmentally appropriate, involve a variety of activities, and be enjoyable.<sup>20</sup> Among middle school students, enjoyment of PE has been related to a desire to continue participation in future PE classes, and has been linked with participation in structured PA or sports outside of school.<sup>1,21</sup>

### School physical environment

Characteristics of school physical environments may influence PA.<sup>14,22</sup> To promote PA, schools must provide safe and enjoyable opportunities and places for youth to be active.<sup>23</sup> The lack of a suitable infrastructure—and/or the perception that a physical space is

inadequate or unsafe—acts to discourage facility use by both children and parents.<sup>10</sup> Haug, Torsheim, Sallis, and Samdal<sup>24</sup> found that outdoor facilities at schools were associated with students' daily PA participation during school breaks. By improving the outdoor environment and other physical features, schools may encourage PA during recess and break times,<sup>25</sup> enhance the PE experience, and contribute to after-school PA participation.<sup>24</sup> Nichol et al<sup>14</sup> found that 6th to 10th grade students with more school PA features and opportunities reported higher rates of both class-time and free-time PA.

### **Recess activity**

Recesses historically have offered additional opportunities for children to be active during the school day. In the past decade, schools have reduced or eliminated recesses/breaks for students in addition to reducing other PA opportunities.<sup>17</sup> Perhaps more important to overall PA than the number or length of recesses and breaks is how youth spend the recess and break time they are given—specifically, whether they are physically active during this time. Interventions have effectively increased PA among students at recess.<sup>26</sup> Additionally, experiences in PE classes and the school's physical environment may influence students' choices to be physically active during school recesses and breaks.<sup>24</sup>

### **Active transport to and from school**

Active transport refers to travel between destinations by walking, cycling, or other non-motorized models.<sup>27</sup> Overall daily PA in youth has been shown to be associated with active forms of transportation.<sup>28,29</sup> Smith<sup>30</sup> found that adolescent girls were more likely to meet recommended PA levels if they actively commuted to school. Unfortunately, the proportion of elementary and middle school children actively commuting between home and school has fallen from 47.7% in 1969 to only 12.7% of comparable students today.<sup>31</sup> Income and socioeconomic status (SES) may play roles in active transport to and from school, but findings are mixed. Garrard<sup>27</sup> found that lower SES students took part in more active transport, whereas Giles-Corti et al<sup>32</sup> found that children attending schools in lower SES areas were no more likely than others to actively commute to school. McDonald<sup>31</sup> reported that low-income and minority groups actively traveled to school more often than whites or higher-income students. Given the potential benefits of active commuting to and from school, it is important to understand the extent to which active transport might contribute to overall levels of youth PA<sup>33</sup> among youth of different ages, sexes, and ethnicities.

The purpose of the current study was to examine the effect of school-related variables on the PA levels of early adolescent African-American, Latino, and white girls. The specific aims were to determine: (1) the effect of hours of PE, enjoyment of PE, the school physical environment, recess activity, and active transport on girls' PA; (2) the extent to which school variables were related to each other; and (3) whether these effects and relationships differed across African-American, Latino, and white girls. Because of established effects of age and income on PA,<sup>2,9,34,35</sup> these 2 variables were controlled for in the analyses.

## METHODS

### Participants

Data are from the first year of a longitudinal study of 372 African-American (N = 128), Latino (N = 120), and white (N = 124) girls residing in the Portland–Gresham, Oregon, metropolitan area. As part of the study design, families having a 10-, 12-, or 14-year-old girl were randomly recruited from 41 socioeconomically diverse and geographically dispersed neighborhoods using telephone, door-to-door, and word-of-mouth methods. Approximately equal numbers of African-American, Latino, and white girls were recruited from each age cohort. Of eligible families, 67.8% agreed to participate.

Given the focus of the current study, only participants attending schools were included in the analyses. The number of participants who were home-schooled was 19; thus, the sample used for analysis was N = 353 (African-American, N = 123; Latino, N = 118; white, N = 112). The mean age was 12.00 years (SD = 1.83). The girls were in grades 4 (16%), 5 (16%), 6 (16%), 7 (18%), 8 (20%), and 9 (14%). The annual household income for the sample was 28% <\$20,000, 50% from \$20,000–\$60,000, and 22% >\$60,000.

**Youth physical activity**—Physical activity is a complex multidimensional behavior; thus, researchers emphasize collecting data from multiple sources whenever possible. The current study included data collected via accelerometer, self-report, parent-report survey, and self-report diary methods. From accelerometer-generated data, we calculated the average daily minutes of moderate to vigorous PA (MVPA) using the number of minutes the child was engaged in combined moderate, vigorous, and very vigorous activity. Child-specific cut points, derived from Freedson, Pober, and Janz<sup>37</sup> were used to determine intensity of activity using ActiLife5 software. Accelerometry is accepted as a reliable and valid method for measuring PA in population-based studies of free-living individuals.<sup>38–41</sup> All participants were asked to wear accelerometers for 7 consecutive days. In the present study, compliance for wearing the device was moderately high, with 89% of girls providing at least 5 days of valid data. Valid days of accelerometer use ranged from 0–7 (mean = 5.66 days [SD = 1.18]). Only two participants had 0 days of valid accelerometer data. All participants' available data were included in the data analyses.

The other PA measures included one youth survey variable, one parent survey variable, and one youth PA diary variable. The youth survey item, based on the Youth Risk Behavior Surveillance System survey (YRBSS, adolescent version)<sup>36</sup> was: "In a typical week, on how many days are you physically active for a total of at least 60 minutes per day?" Responses ranged from 0 to 7 days. The parent survey item was the same, but asked about the daughter's PA. The youth PA diary variable represented the girl's total minutes of PA over the past 7 days, derived from a 7-day PA diary in which girls recorded the type and duration of their daily physical activities. Because these 3 variables were obtained from similar methods (surveys and diary) they were combined to form a latent method factor representing girls' physical activity (PA factor). The latent variable approach is a powerful technique for the operationalization of PA, as it offers an efficient and appropriate way to combine several PA variables into one factor for analysis. The use of a latent variable approach to analyses is also advantageous because it accounts for measurement error and the analysis of

disattenuated parameter estimates between groups, and increases power without the need to increase sample size or obtain a larger effect size.<sup>42</sup> Thus, these 3 variables were combined within the latent variable structural equation modeling analysis to form a latent factor outcome variable representing a general measure of PA (PA factor).

**School variables**—PA-related school variables were generated from youth and parent survey items, which had been adapted from Sallis, Frank, Saelens, and Kraft,<sup>43</sup> Zakarian, Hovell, Hofstetter, Sallis, and Keating,<sup>44</sup> and the YRBSS (adolescent version).<sup>36</sup> Total hours of annual physical education (PE) was calculated from three items on the parent survey: (1) “How much of this school year does your daughter take PE?” (2) “When your daughter takes PE, on how many days does she go to PE classes?” and (3) “On average, how long does each PE class last?” Original responses were recoded based on a 180-day school year, then recoded responses to the 3 questions were multiplied together and divided by 60 to obtain total hours per year (this variable was divided by 100 to place it on a scale similar to others in the model). Youth-reported PE enjoyment was measured with one question: “How much do you enjoy physical education classes at school?” with responses ranging from 1 (don’t enjoy at all) to 5 (greatly enjoy). Self-reported recess activity was measured with one item: “On a typical day, what do you spend most of your time doing during recess/free time at school?” with the following possible responses: playing games or sports, standing or sitting, running, walking, playing on playground equipment, and doing schoolwork. A dichotomous variable was created to distinguish inactivity (eg, standing or sitting) from activity (eg, playing games or sports). The physical environment subscale from the Questionnaire Assessing School Physical Activity Environment (Q-SPACE)<sup>15</sup> was used to document the school environment for PA, reported by the parent. The subscale was calculated by averaging 10 items, such as “The outdoor areas at my daughter’s school are in good condition,” with responses ranging from 1 (strongly disagree) to 4 (strongly agree). The internal consistency reliability for this subscale was  $\alpha = .89$ . To measure active transportation to and from school, 2 survey items were used. Girls were asked: “How many days in a typical school week do you walk, bike, skateboard, rollerblade, or ride a scooter to [from] school?” with responses ranging from 0 (0 days) to 4 (every day). The 2 items (to and from school) were summed. The correlation between parents’ and girls’ summed responses was  $r = .70$  ( $p < .001$ ); thus, girls’ summed responses were averaged with parents’ summed responses to create an active transportation to school variable.

**Demographic variables**—Age and family income per capita (family income measured in six categories, divided by number of family members) were included in the models to control for their possible effects on PA and school influences.

## Procedures

The target girl and a parent completed surveys in their home. Girls younger than 12 years of age were administered the survey as an interview. Spanish-language surveys were provided for Spanish-speaking participants. Survey visits lasted about 30–75 minutes. Participants completed individual surveys in private, away from other family members, to enhance confidentiality. For 7 days, girls were asked to keep a PA diary and to wear a GT3X+ ActiGraph accelerometer device on an elastic band around their waist provided by the

project for 24 hours a day (except in water). Girls were paid \$50 to complete the entire assessment; parents were paid \$30. Data were collected in 2011–12.

## Data Analysis

We used structural equation modeling (SEM) to examine relationships among school variables, a PA latent factor, and minutes of MVPA. The 2 outcome variables were the PA latent factor (comprised of 3 observed variables) and the accelerometer-measured MVPA variable. These 2 outcome variables were specified to co-vary in the model. School variables were regressed on the PA factor and the MVPA variable; school influences were specified to co-vary with each other, and age and family income per capita were included as covariates of the PA factor, MVPA variable, and school variables. Figure 1 illustrates the theoretical model in which school influences were hypothesized to relate to both the PA factor and the MVPA variables.

To test for the effects of ethnic group, multiple-group (by ethnicity) SEM was employed. Multiple-group analyses permit simultaneous evaluation of results across multiple populations.<sup>42,45</sup> Models were estimated using *Mplus* software (version 6.1).<sup>46</sup> *Mplus* uses an expectation maximization (EM) algorithm which allows for the handling of missing data, enabling the inclusion of all participants' data in the analyses. The analyses tested for significant differences by ethnic group in regression parameters, covariances, and means and variances.

## RESULTS

Means and variances for the original observed variables are shown in Table 1.

A preliminary multiple sample (3 group by ethnicity) model without covariates (unconditional model) showed that the 3 survey and diary PA measures loaded significantly on a PA latent factor, making the factor a viable and reliable PA outcome in the model, along with the outcome of accelerometer-measured minutes of MVPA. This model revealed significant differences across groups for the means of the PA factor (Latino girls significantly lower than African-American and white girls), MVPA (African-American girls significantly higher than Latino and white girls), hours of PE (Latino girls significantly fewer than African-American and white girls), PE enjoyment (African-American girls significantly higher than Latino and white girls), and active transport to and from school (all ethnic groups significantly different from each other: Latino girls highest, followed by African-American girls and then white girls).

For the covariates included model (conditional model), equality constraints were initially placed across the 3 ethnic groups on the regression coefficients, covariances, means, and variances of all variables in the model (except for age and income means and variances, which were left unconstrained). The placing of these constraints helps test whether or not the model's statistics are similar or statistically different across groups. Generally acceptable SEM fit index values are a non-significant chi-square, comparative fit index (CFI) and Tucker-Lewis Index (TLI) equal to or greater than .95, and .06 or less for the root mean square error of approximation (RMSEA).<sup>44,47–49</sup> Model fitting procedures for the



hypothesized fully constrained model yielded the following fit indices:  $\chi^2(153, N = 353) = 213.185$ ,  $p < .001$ , CFI = .866, TLI = .858, and RMSEA = .058. Results of the Modification Indices (MI) in *Mplus* revealed that there were a number of constraints across groups that, if relaxed, would result in a significant chi-square decrease. Only appropriate constraints were relaxed. The model was rerun, removing one constraint at a time, until no further relaxed constraints would result in improved model fit.

### Model fit

The final model (with significant cross-group constraints relaxed) resulted in the following acceptable fit indices:  $\chi^2(143, N = 353) = 139.068$ ,  $p = .577$ , CFI = 1.000, TLI = 1.010, and RMSEA = .000. In the SEM model the paths were tested at a significance level of  $p = .05$ . It should be noted that whereas inflated probabilities can be a concern in conducting multiple tests, SEM is different in that it simultaneously tests multiple coefficients in a single model. For this reason, the current study uses a family-wise error rate of  $p = .05$  for the model's tests.

### Regression effects

Regression effects, and differences across ethnic groups, are presented in Table 2. For all girls, more PE time was related to higher levels of PA (factor) ( $b = .129$ ,  $p < .01$ ), and older African-American and white girls had significantly more PE time than younger girls ( $b = .117$ ,  $p < .05$ ). Active transport to/from school was positively related to the PA factor for white girls only ( $b = .094$ ,  $p < .05$ ), and to minutes of MVPA for African-American girls only ( $b = 4.079$ ,  $p < .001$ ). Across the 3 ethnic groups, there were significant negative relationships between age and MVPA ( $b = -18.313$ ,  $p < .001$ ), recess activity ( $b = -.084$ ,  $p < .001$ ), and PE enjoyment ( $b = -.240$ ,  $p < .001$ ); that is, older girls had fewer minutes of MVPA, were less active at recess, and enjoyed PE less than younger girls. Also, for all ethnic groups, higher income was associated with less active transportation ( $b = -.711$ ,  $p < .05$ ).

### Correlations

Correlations, and differences across ethnic groups, are presented in Table 3. The PA factor and accelerometer-measured minutes of MVPA were significantly positively related ( $r = .558$ ,  $p < .001$ ), but only for Latino and white girls. PE hours were significantly positively related to PE enjoyment for African-American ( $r = .149$ ,  $p < .05$ ) and white ( $r = .182$ ,  $p < .05$ ) girls, and with the school physical environment for PA for African-American ( $r = .232$ ,  $p < .01$ ) and Latino ( $r = .285$ ,  $p < .01$ ) girls. Greater PE enjoyment was related to more recess activity among African-American and Latino girls ( $r = .273$ ,  $p < .001$ ), and greater PE enjoyment was associated with more active transportation to school for all girls ( $r = .112$ ,  $p < .05$ ). For African-American girls only, the school physical environment for PA was negatively correlated with active school transport ( $r = -.191$ ,  $p < .05$ ) (the relationship was non-significant for the other 2 groups). The final model also indicated that African-American girls had greater residual variance in annual hours of PE and a higher intercept for the PA factor compared to Latino and white girls.

## DISCUSSION

Despite the importance of assessing school influences on youth PA levels,<sup>11</sup> few studies have examined the effects of school-related variables on PA in samples of ethnically diverse girls. Our study explored the effects of hours of PE, enjoyment of PE, the school PA physical environment, recess activity, and active transport to and from school on girls' PA—as well as relations among these variables—across African-American, Latino, and white subgroups.

A key finding was the significant relationship between hours of PE and girls' PA. More PE was associated with higher levels of PA (as measured by the PA latent factor), consistently across all 3 ethnic groups. This result is consistent with the McKenzie et al.'s<sup>19</sup> study that documented a contribution of PE to overall PA. Of additional importance was the finding that active transport to and from school had a significant impact on the PA factor as well as accelerometer-measured minutes/day of MVPA, but only for select groups. Among white girls, more active transportation to and from school was related to higher levels of the PA latent factor, whereas among African-American girls, more active transport was related to more minutes/day of MVPA.

It was expected that the variables including some level of PA (eg, PE and active transportation) would be related to the PA outcomes, but these relationships were not as strong as might have been predicted, and they differed across ethnic groups. PE annual hours, although significantly related to the PA latent factor for all 3 ethnic groups, was not significantly related to MVPA for any ethnic group. Active transportation was not significantly related to either of the 2 PA outcomes for Latino girls, and was related to different PA outcomes for African-American and white girls. These differences may be a result of the different measurement methods, and clearly require further investigation and clarification; however, the results also highlight the potentially important role of PE and active transportation to and from school in contributing to girls' daily levels of PA.

PE enjoyment was related to hours of PE for African-American and white, but not Latino, girls, and older girls had significantly more hours of PE than younger girls—but, again, only for African-American and white, but not Latino, girls. Latino girls also had significantly fewer hours of PE than African-American and white girls. The age-related finding is not unexpected because middle schools in this geographic region often have more PE than elementary schools. As expected, older girls had significantly fewer PA minutes/day (MVPA) than younger girls.<sup>2,9</sup> Moreover, across the 3 ethnic groups there was a significant negative relationship between age and PE enjoyment, with older girls enjoying PE less than younger girls.

We found a significant positive association between the school physical environment and hours of PE for African-American and Latino, but not white, girls. However, in general, the school physical environment was not associated with girls' PA or other school-related variables. Findings in this area have been equivocal. Haug, Torsheim, Sallis, and Samdal<sup>24</sup> reported that outdoor facilities in schools were associated with students' daily PA participation during school breaks, but other studies have found weak relationships between



school recreational facilities and PA.<sup>11,16,50,51</sup> These mixed results may reflect the different measures and/or different samples studied. The lack of significant results concerning the school physical environment in our study does not negate the importance of the environment, but it suggests the need for further research to examine the impact of the school physical environment on different types of PA, as well as overall PA, given the potential for the school environment to encourage PA.<sup>24</sup>

In addition to the effects of active transport to and from school on PA and MVPA for select groups, a significant positive relationship emerged between greater PE enjoyment and active transport to and from school. For all 3 ethnic groups, more PE enjoyment was associated with more active transport, suggesting that positive experiences in school PE may encourage activity. The results also showed that higher income was related to less active transport, which supports findings from prior studies.<sup>27,52</sup> The possible reasons for this are many, including distance to and from school; perceived safety of routes to school; parents' preferences; and other social, policy, and environmental factors that affect travel choices.<sup>27</sup> Results from this study underscore the need to encourage more active transport—specifically among children from higher-income families.

Interestingly, we found that greater PE enjoyment was related to more recess PA. The relationship was significant for African-American and Latino girls, and suggests that African-American and Latino girls who enjoy PE classes may want to be active during other free time at school. This result points to the importance of making PE classes enjoyable, as the impact of the PE experience may extend beyond the class to influence choices during school and non-school time.<sup>24</sup> The study also showed that older girls were less active at recess than younger girls—a consistent pattern across African-American, Latino, and white girls—supporting prior research findings that older children spend more recess time socializing and standing, and less time being physically active, compared to younger children.<sup>53</sup> This may partially reflect the structure of the middle school/high school day compared to the elementary school day. Middle and high school students generally have only one recess time, during the lunch period, whereas elementary school students typically have at least one recess break outside of the school lunch period. Tying one's only recess to the lunch period may promote more sedentary, rather than physical, activities.

An interesting methodological result also emerged in this study. The PA measures (PA latent factor and accelerometer data) were significantly positively related for Latino and white, but not African-American, girls. This result indicates that when combined in a latent factor, self-report, parent-report, and self-reported diary data were significantly related to more objectively measured PA for Latino and white girls, but not for African-American girls. This finding is worthy of future research attention, as it may indicate that different measurement methods are more valid and reliable for different youth ethnic groups.

## Limitations

Our study has several limitations, including the use of cross-sectional data, which does not allow causal inferences. The school variables were limited to those measured in the current study. For example, participation on school teams or intramural sports activities were not included, although such participation may exert a positive influence on overall PA levels

and influence PA beyond the school environment.<sup>54</sup> The school physical environment measure was reported by parents only. Children's reports of the school physical environment, and/or observational data, might offer a different perspective. A student's choice to take PE, not measured in this study, also may provide a partial explanation of the relationship between PE and other variables. The analyses controlled for known effects of age and household income, but there may be other factors that should be included in future studies. It also should be noted that different PA measurement methods and items generate different PA data, often making it hard to directly compare PA variables. PA is a complex behavior to measure and no single assessment method is without limitations. For example, both self-report and parent-report data have been criticized for reporting biases, whereas accelerometers have problems related to compliance, amount of data attained, and inability to capture certain types of PA (eg, water sports, cycling). However, because of the complexity of PA, multiple PA measures are generally considered to represent strong points in studies.

Strengths of the study include the use of multiple informants; multiple measurement methods, including objectively accelerometer-measured MVPA and a PA latent factor; the randomly recruited sample; and a design that documented similarities and differences across African-American, Latino, and white early adolescent girls. In addition to the significance of findings in the current study, it also is important to consider the magnitude or strength of these relationships. The magnitude of relationships in the current study were varied and generally modest, suggesting there are likely other important covariates to consider when examining influences on girls' PA levels. Future research should continue to recruit ethnically diverse groups; examine similarities and differences across these groups in the relationships between school influences and overall PA levels; and explore how these relations change with age.

## Conclusions

We found that hours of PE and active transport to and from school emerged as key school variables significantly related to early adolescent girls' overall PA. Numerous significant relationships between the school-related variables were of interest, including associations between greater PE enjoyment with more active transportation to and from school, and more activity at recesses and breaks. Some findings were consistent across African-American, Latino, and white girls, but there were also a number of significant differences, highlighting the importance of examining PE and PA relationships across and within subgroups. More research is needed to examine the relevance of school physical environments with girls to ensure these environments are appropriately tailored for them.<sup>11</sup> Analysis of the most physically active subgroups (by sex and ethnicity) may inform school-related strategies to promote PA. The least physically active subgroups may be the most important groups to target for school-based PA interventions.<sup>55</sup>

## IMPLICATIONS FOR SCHOOL HEALTH

A key finding of the current study was the importance of PE to all girls' levels of self- and parent-reported PA. Clearly, PE participation can make a significant contribution to overall PA levels of early adolescent girls. In addition, active transportation to and from school

appears to significantly contribute to PA levels of African-American and white girls. Because greater enjoyment of PE is related to active transportation to and from school, as well as more recess PA, it is important that schools not only provide opportunities for quality PE classes, but also ensure that PE is enjoyable for all girls, especially the least physically active pre-adolescent and early adolescent girls. Tailoring may be needed to make PE enjoyable for girls in specific ethnic subgroups. Latino girls, in particular, may need extra encouragement to participate. Thus, physical educators should ensure that competitive and non-competitive activities are included as well as those popular to ethnic subgroups, such as different forms of dance. Girls also will likely enjoy their PE experience more if they are given a variety of different physical activities from which to choose. Frequent changes in activity will likely enhance the PE experience and prevent boredom or frustration.

In addition, schools and school districts are advised to foster the use of active transport to and from school, which represents a more equitable and inclusive form of PA than organized sport and exercise programs.<sup>27</sup> Policies that encourage active transportation by students include factors related to the built environment, such as school speed zones, the presence of sidewalks, crosswalks, and crossing guards plus additional policies related to school start/dismissal times and policies that encourage students to attend neighborhood schools.<sup>56</sup> Programs such as Safe Routes to Schools and the Walking School Bus can be adopted by schools to increase regular active transportation to and from school. Schools also can establish and promote their own regular “Walk or Bike to School Days,” provide route and safety information and small incentives to children and parents, and develop school-wide team or classroom competitions to encourage more active transport to and from school. Successful programs will require the commitment of school administrations and teachers, plus active involvement of parents.<sup>57</sup>

Although we did not find a significant association between the school PA environment and girls’ PA, school and school district practices that encourage PA are still recommended. School facilities that are attractive and available for PA will benefit the community in general. Joint use agreements that use school facilities but share the costs and responsibilities of facility maintenance can be used to the benefit of all students.

It is unlikely that children will meet the recommended levels of physical activity through PE, active transportation, recess activities, or after-school sports programs alone. Additionally, there are likely to be variations in suitability and attractiveness of each source of PA for different social groups. Therefore, efforts to promote PA will likely be most successful if multiple approaches are adopted involving P.E., recess, in-classroom activity breaks, active transport, and after-school PA programs.

### Human Subjects Approval Statement

This study was approved by the Oregon Research Institute Institutional Review Board. All adult participants gave informed written consent and all girls gave informed written assent prior to study participation.

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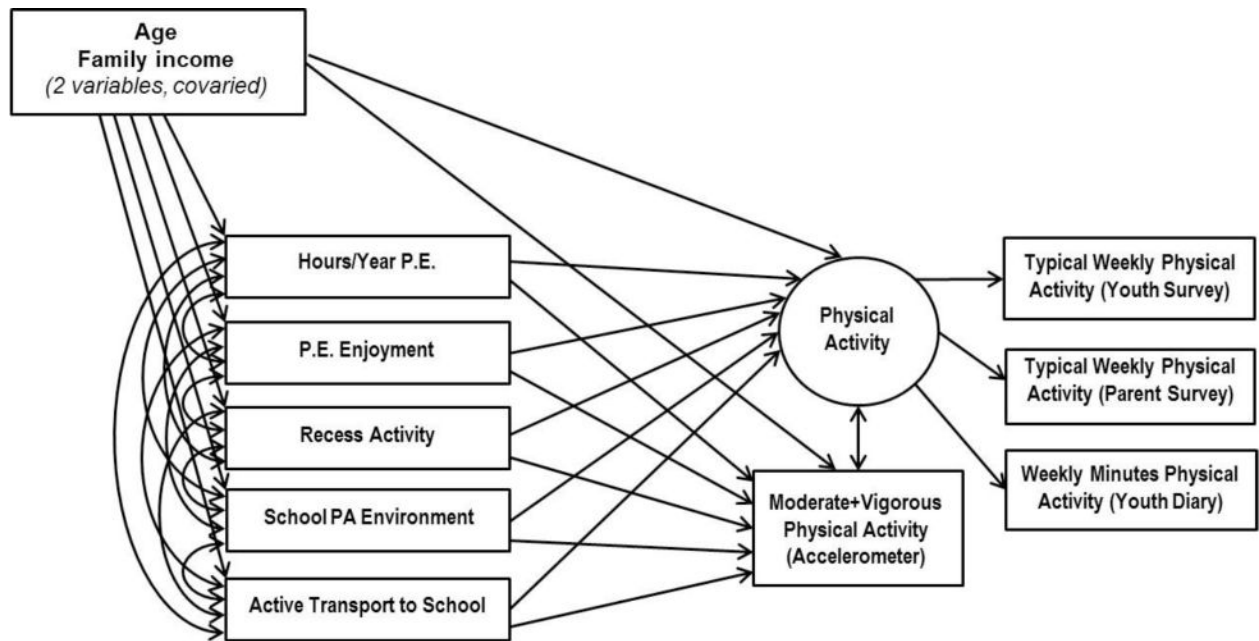
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**Figure 1.**  
Illustration of the Theoretical Model.

*Notes.* Two covariates (age and family income) and 5 school-related variables (physical education [PE], PE enjoyment, recess activity, the school physical activity environment, and active transport to school) are hypothesized to relate to a physical activity factor (measured by three variables: youth- and parent-reported typical weekly physical activity, and youth-reported weekly minutes of physical activity) as well as the accelerometer-measured variable of moderate+vigorous physical activity. The multiple-group model employed in this study estimated regression parameters, covariances, and means and variances—and tested for significant differences in these estimates—across African-American, Latino, and white ethnic groups.

**Table 1**

## Descriptive Statistics of Variables in the Models

	<b>African Americans Mean (SD)</b>	<b>Latinos Mean (SD)</b>	<b>Whites Mean (SD)</b>
Age (years)	11.88 (2.01)	11.90 (1.59)	12.08 (1.67)
Income per capita (6-point scale divided by # family members)	.74 (.44)	.66 (.57)	1.09 (.51)
Typical days/week PA (youth)	4.42 (1.76)	3.71 (1.93)	4.21 (1.80)
Typical days/week PA (parent)	4.30 (1.98)	3.13 (2.12)	3.93 (1.75)
Minutes/week PA (youth diary)	485.47 (297.17)	435.27 (294.99)	532.62 (359.00)
Minutes/day moderate+vigorous PA (accelerometer)	106.81 (61.69)	95.62 (49.21)	90.83 (47.21)
Annual hours PE/100 (parent)	2.59 (1.73)	1.84 (1.44)	2.34 (1.46)
% active at recess (youth)	71 (46)	65 (48)	72 (45)
PE enjoyment (youth)	4.14 (1.02)	3.90 (1.06)	3.93 (1.02)
School physical environment (parent)	3.14 (.51)	3.04 (.59)	3.03 (.51)
Days active transport to/from school (youth and parent)	2.49 (2.64)	2.54 (2.89)	2.04 (2.71)

**Table 2**

Regression Effects and Differences across Ethnic Groups in the Final Model

	African Americans b	Latinos b	Whites b
Age → PA factor	-.006	-.006	-.006
Family income → PA factor	.014	0.014	0.014
PE annual hours → PA factor	.129**	.129**	.129**
PE enjoyment → PA factor	.124	.124	.124
Recess activity → PA factor	.193	.193	.193
School PA environment → PA factor	-.006	-.006	-.006
Active transport → PA factor	-.053	-.053	.094* <sup>1</sup>
Age → MVPA	-18.313***	-18.313***	-18.313***
Family income → MVPA	4.055	4.055	4.055
PE annual hours → MVPA	.502	.502	.502
PE enjoyment → MVPA	1.767	1.767	1.767
Recess activity → MVPA	7.263	7.263	7.263
School PA environment → MVPA	-5.488	-5.488	-5.488
Active transport → MVPA	4.079*** <sup>1</sup>	.200	.200
Age → PE annual hours	.117*	.066 <sup>1</sup>	.117*
Age → PE enjoyment	-.240***	-.240***	-.240***
Age → Recess activity	-.084***	-.084***	-.084***
Age → School PA environment	-.006	-.006	-.006
Age → Active transport	-.014	-.014	-.014
Income → PE annual hours	-.037	-.037	-.037
Income → PE enjoyment	.027	.027	.027
Income → Recess activity	-.027	-.027	-.027
Income → School PA environment	-.070	-.070	-.070
Income → Active transport	-.711*	-.711*	-.711*

Note. Effects denoted by \*, \*\*, and \*\*\* are significant at  $p < .05$ ,  $p < .01$ , and  $p < .001$ , respectively.

<sup>1</sup> The effect significantly differs from this group and other groups (equality constraint relaxed). For instance, the partial regression effect of PE annual hours on the PA latent factor was .129 (significant at  $p < .001$ )—indicating that increased annual hours of PE was associated with increased physical activity, holding all other predictors constant—and the effect did not significantly differ across ethnic groups.

**Table 3**

Correlations and Differences across Ethnic Groups in the Final Model

		African Americans Corr.	Latinos Corr.	Whites Corr.
PA factor with MVPA		.162 <sup>I</sup>	.558***	.558***
Hours PE with:	PE enjoyment	.149*	-.140 <sup>I</sup>	.182*
	Recess activity	.009	.011	.011
	School environment	.232**	.285**	.035 <sup>I</sup>
	Active transport	-.030	-.037	-.037
PE enjoyment with:	Recess activity	.273***	.273***	-.041 <sup>I</sup>
	School environment	.053	.053	.053
	Active transport	.112*	.112*	.112*
Recess activity with:	School environment	.053	.053	.053
	Active transport	.036	.036	.036
School environment with:	Active transport	-.191* <sup>I</sup>	.085	.085

Notes. Correlations denoted by \*, \*\*, and \*\*\* are significant at  $p < .05$ ,  $p < .01$ , and  $p < .001$ , respectively.

<sup>I</sup>The effect significantly differs between this group and other groups (where the equality constraint across groups was relaxed).