Classes of Physical Activity and Sedentary Behavior in 5th Grade Children

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***Objectives*: We identified classes of physical activity (PA) and sedentary behaviors (SB) in 5th grade children, associated factors, and trajectories of change into 7th grade. *Methods*: This study included N = 495 children (221 boys, 274 girls) who participated in the Transitions and Activity Changes in Kids (TRACK) Study. PA was assessed objectively as well as by self-report. Children, parents, and school administrators completed surveys to assess related factors. Latent class analysis, growth modeling, and adjusted multinomial logistic regression procedures were used to classify children based on self-reported PA and SB and examine associated factors. *Results*: Three classes of behavior were identified: Class 1: Low PA/Low SB; Class 2: Moderate PA/High SB; and Class 3: High PA/High SB (boys) or Class 3: High PA (girls). Class 3 children had higher levels of self-efficacy (boys), and enjoyment, parental support, and physical activity equipment at home (girls). Class 2 boys and Class 3 girls did not experience decline in PA (accelerometer) over time. *Conclusions*: Self-efficacy (boys) and home environment (girls) may play a role in shaping patterns of PA in children. Findings may help to inform future interventions to encourage children to meet national PA guidelines.**

***Key words*: latent class analysis; physical activity; sedentary behavior; child health**

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Childhood obesity has reached epidemic proportions in the United States (US) – approximately 17% of children ages 6-11 and 21% of children ages 12-17 years old are considered to be obese.[1] Childhood obesity has been associated with numerous negative health outcomes, including higher risk of the precursors for cardiovascular disease, diabetes, bone and joint problems, sleep apnea, and social and psychological problems.[2] Researchers attempting to understand a phenomenon as complex and pervasive as childhood obesity have adopted a socioecological framework. The socioecological model of health behavior posits that individuals function within multiple nested levels or social contexts that influence their health behaviors (ie, individual, intrapersonal, community/societal).[3,4] Physical activity has been identified as one modifiable behavior that can be targeted to improve and maintain weight status, as well as yield other health benefits.[5,6]

Despite national guidelines that encourage children to be active for at least 60 minutes per day on most days, only a small percentage of children meet this recommendation.[7-9] Furthermore, there is a marked decline in physical activity as children transition from elementary to middle to high school and beyond.[10,11] Interventions designed to increase physical activity and/or reduce sedentary behavior in children have had some success;[12-15] however, success rates vary by age, sex, socioeconomic status (SES), and other contextual factors. Tailoring interventions to serve the target population more appropriately can increase program efficacy and effectiveness. Specifically, identifying patterns of physical activity and sedentary behavior in children may help to tailor interventions to improve outcomes. Additionally, a detailed understanding of the characteristics of children within each class of behavior may provide further help in tailoring the program, thereby increasing its effectiveness to help children meet national guidelines.

A 2014 review of the literature examined the clustering of obesogenic behaviors in children and adolescents and their association with SES and overweight/obesity.[16] This review revealed that

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the cluster pattern most frequently observed was a mixed physical activity/sedentary behavior pattern, and that clusters differed by age, sex, and SES. Additional studies have been published on the topic since then to expand knowledge of these behavior patterns. For example, one study reported that health-related behavior patterns are linked with subsequent change of weight status and self-rated health in adolescents.[17] Moreover, those high-risk patterns of low physical activity and high sedentary behavior had the strongest increase in prevalence of overweight over time. However, most of these studies limited their description of the classes to SES or individual-level characteristics,[18-20] overlooking other interpersonal- and school-level factors that may be important for intervention development.

As such, the purpose of the current research guided by a socioecological framework, is 3-fold: (1) to identify classes of physical activity and sedentary behaviors reported by children in 5th grade, (2) to examine the association of those classes with putative individual-, interpersonal-, and school-level determinants of behavior, and (3) track associated trajectories of change in physical activity into 7th grade.

METHODS

Participants and Setting

Data were drawn from the Transitions and Activity Changes in Kids (TRACK) Study, a multi-level, longitudinal study of influences on the changes in children's physical activity as they transition from elementary to middle school. The original sample of 5th grade participants was N = 1083. The majority of children were girls (54.4%) with an average age of 10.5 (0.6) years and a racial/ethnic breakdown of 37.6% white, 34.1% black, 10.8 Hispanic and 17.6% other race/ethnicity. The present analyses included data on a total of 495 students (221 boys and 274 girls) who had data in both 5th grade (baseline) and 7th grade.

Children were recruited from 21 public elementary schools in 2 school districts in South Carolina. District approval was obtained through meetings with district superintendents and administrators prior to soliciting school participation. All 7 of the elementary schools in one district (Site A) and 14 of the 17 elementary schools in the other district (Site B) agreed to participate. Recruitment assemblies were held in all schools, during which 5th graders were invited to participate in the study and received information regarding the data collection procedures. Informed consent packets were sent home with the children for their parents to read, complete, and return. Children also gave their assent before beginning any study procedures.

Sixty-four percent of recruited 5th grade students at site A and 57% of recruited 5th grade students at Site B provided consent and assent. Students were excluded from the study only if they had: (1) an orthopedic or other condition that would invalidate the measure of physical activity (eg, wheelchair-bound); and/or (b) intellectual limitations that would preclude appropriate completion of the survey instruments. Consenting students were representative of age, sex, and race/ethnicity of the students attending schools in those districts.

Data collection procedures occurred over 2 sessions at the school with each participant and were administered by a trained measurement team. During Session 1, participants completed a survey, had anthropometric measures taken, and received an accelerometer. Participants completed the measures in small groups (≤24 students) at a place and time determined by the school administration. Participants also were given a paper-and-pencil survey for their parents to complete and return to the measurement team during a subsequent session. At Session 2, participants returned their accelerometer and parent surveys, and received a modest incentive. Throughout this time, school administrators and physical education teachers at each of the 21 schools also completed a paper-and-pencil survey and returned it to the measurement team.

Measures

Physical activity variables. Physical activity was measured by accelerometry (ActiGraph GT1M and GT3X models, Fort Walton Beach, FL). The ActiGraph has been validated for use with children and has high inter-rater reliability and strong correlations with energy expenditure. Children wore the monitors on their right hip for 7 consecutive days during most waking hours, except when sleeping or doing water-related activities (eg, bathing or swimming). Monitors were initialized prior to data collection and were set to begin collecting data at 5:00am on the day after they were distributed to participants at school. Data were collected and stored in 1-minute intervals. Non-wear time, ie, any period of 60 or more minutes of consecutive 0*s*, was recoded as missing.

The threshold for moderate physical activity was 2200 counts/min corresponding to 4.0 metabolic equivalents (METs; 1 MET = 3.5 mL O2 X kg-1 X min-1).[21] Accumulated minutes per hour of moderate-to-vigorous physical activity (MVPA) was determined for each participant. Prior to imputation, the percentage of children who had accelerometer data for ≥ 8 hours/day on ≥ 4 days was 80% (545 girls, 463 boys) at the 5th grade measurement and 67% (412 girls, 354 boys) at the 7th grade measurement. On average, 73% of total possible records from Monday to Saturday were available over the 3 years. Missing accelerometer data were imputed separately by sex for children with 2 or more days with at least 60% (≥ 8 hours) of daily wear using PROC MI in SAS.[22] Imputed days and/or hours of wear were based on the child's data record from the remaining days.

The Physical Activity Choices (PAC) instrument was used to measure participation in specific forms of activities. The PAC was based on the

3DPAR instrument,[23] but instead of asking about the activity performed during specific time blocks, participants responded about *any* participation in the activity *over the past 5 days* (which may or may not have included any weekend days). Participants completed the PAC using a computer-assisted, self-administered protocol and were guided through a list of 56 activities (7 sedentary, 49 physical activities). If they responded 'yes,' they were asked about the number of days the activity occurred and how long they did the activity on each occasion (average minutes). Assessing physical activity over multiple days, as done here, has been shown to provide valid and reliable estimates of usual activity in children as young as 5thgrade.[24,25]

For this analysis, activities were grouped into 6 categories: (1) educational sedentary (N = 3; music lessons/practicing an instrument, reading, homework); (2) electronic media (N = 4; watching TV or a movie, playing video games, talking on the phone/texting, listening to music); (3) individual physical activities (N = 21; aerobics, bowling, calisthenics/exercises, canoeing/kayaking, dancing, cardio machine, Frisbee, hiking, horseback riding, jumping rope, kickboxing, martial arts, playground games, playing catch, running/jogging, swimming/pool play, trampoline jumping, walking for exercise, weightlifting, yoga/Pilates/stretching, and gymnastics); (4) team sports (N = 12; basketball, cheerleading/drill team, golf, football, hockey [ice, field, street or floor], baseball/softball, soccer, swimming laps, tennis/racquetball/badminton/paddleball, track & field, volleyball, wrestling); (5) lifestyle activities (N = 2; playing with younger children, walking for transportation); and (6) wheel activities (N = 4; bicycling/mountain biking, roller blading/ice skating/roller skating, riding scooters, skateboarding).

Individual-level factors. Participants completed a 106-item survey that included questions related to their physical activity behaviors, attitudes, and perceptions. Self-efficacy for overcoming physical activity barriers was assessed using an 8-item questionnaire that participants responded to on a 5-point Likert-type scale.[26-28] Enjoyment for physical activity was assessed by the mean of scores on 4 items on a 4-point scale. Perceived barriers to physical activity were assessed using the mean of scores on 5 items on a 4-point scale.[29] This scale included items to assess obstacles, evaluation, and outcomes as barriers to physical activity. Parent support for physical activity was assessed using the mean of scores for 8 items on a 5-point Likert-type scale.[30] Participants reported with what frequency, during a normal week, their parents provided tangible (eg, transportation, participate with child) and intangible (eg, encourage) support (response options ranged from "none" to "daily").

Interpersonal-level factors. Parents completed an 85-item survey that included questions related to their personal and their child's health behaviors. Four items related to parent support for physical activity were adopted from a previous study.[31] Items assessed the number of days in a typical week parents provided both tangible (eg, transportation, participating with child) and intangible support (eg, encouragement). Three items were used to assess parent's perception of their child's neighborhood safety; these items were validated in a previous study[30] and more information has been previously published.[32] Additionally, parents reported the number of sports/physically active lessons in the past year that the child participated in and the number of screen devices (ie, TV, computer, game console) in the child's bedroom. A 14-item home physical activity resource checklist adopted from a previous study[31] was used to provide information about number of physical activity resources at home or in the yard. The scale was found to have good test-retest reliability.

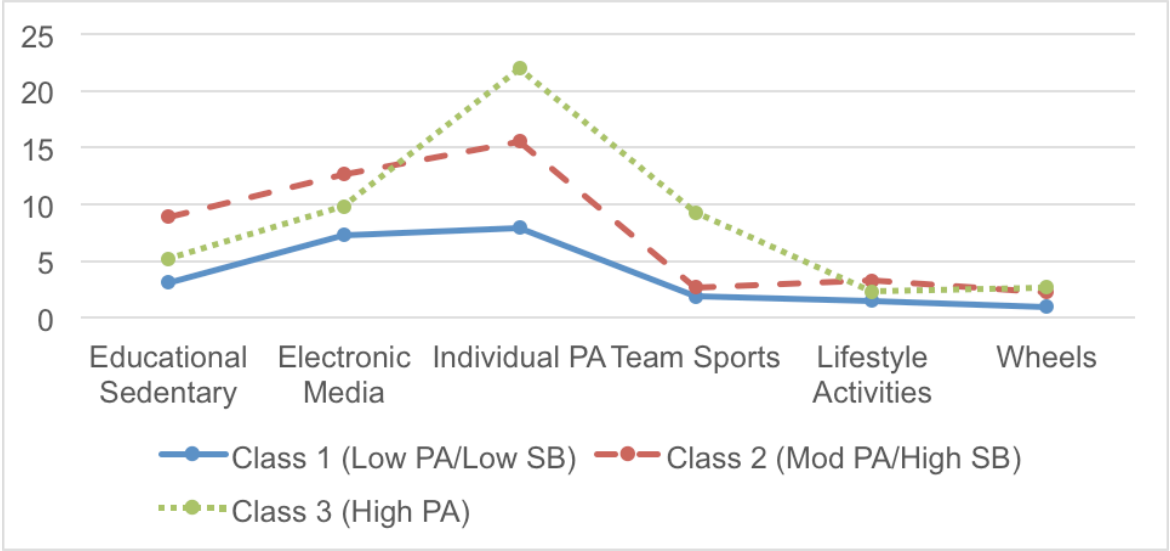
School-level factors. Surveys were completed by a school administrator and a physical education teacher at each of the 21 schools. These surveys included questions from the School Health Policies and Programs Study (SHPPS).[33,34] The administrator reported weekly minutes of recess, school climate,[35,36] and faculty wellness. Physical education teachers reported yearly minutes of physical education, availability of intramurals, number of intramural activities, outdoor facilities, community linkage, and teacher characteristics. A School-Support for Physical Activity index was created by summing the 5 teacher (recess, recess policy, facilities, PE characteristics, and community linkages) and 4 administrator (recess, recess policy, after school PA, and community linkages) subscales. Participants were divided into 2 groups based on a mean split score of the index (Low School Support for PA ≤ 13; High School Support for PA >13).

Socio-demographics. Participant height and weight was measured by trained staff at baseline using Shorr measuring boards and Seca model 770 scales. With this information, body mass index (BMI) was calculated using the standard equation (body weight [kg] / height [m]^2). Participants also reported their age, sex, and race/ethnicity. For race, they were asked to check as many categories as applied (white, black/African American, Asian, American Indian/Alaskan Native, and other). They also were asked to identify whether they considered themselves Hispanic or Latino. Race/ethnicity responses were re-coded as black, white, Hispanic and other/mixed race. Parents reported their highest level of education and item responses were recoded to 'high school or less' and 'more than high school.' Percent poverty was calculated using the US Census American Community Survey variable "Poverty status in the past 12 months" based on the Census tract of each child's place of residence.[37]

Statistical Analysis

Boys and girls in the cohort were classified separately according to the 6 categories of activities using latent class analysis (LCA) by M*plus* 7.3.[38] LCA

Figure 1
Patterns of Physical Activity and Sedentary Behavior (Mean Number of Episodes) by Latent Class (Boys N = 221)



provided Bayesian probability estimates of children being classified into physical activity groups based on their observed status each year. Model fit was tested using a robust maximum likelihood ratio test, with standard errors of the parameter adjusted for nesting of students in elementary schools. The number of classes was tested by a significant chi-square change (χ^2 Δ) estimated by a bootstrapped likelihood ratio test.

To explore differences in patterns of physical activity and sedentary behaviors between the classes, we computed mean number of episodes within a category. Episodes were defined as the number of days in the past week the participant reported engaging in the activity in the past 5 days, summed across all activities in the category.

Descriptive statistics (percentages or means and standard deviations or standard errors) were calculated to describe the sample characteristics of the emergent classes for both boys and girls. Chi-square, t-test, and adjusted multinomial logistic regression procedures were completed to estimate differences between the classes on various demographic, individual-, interpersonal-, and school-level factors using SAS 9.3 statistical software (SAS Institute, Cary, NC, USA).

Trajectories of change in MVPA were estimated using latent class growth modeling using Mplus 7.3 with robust maximum likelihood estimation, which is robust to non-normality with up to 25% missing data. Initial scores in the 5th grade and growth models of change through 7th grade were compared between latent classes based on the Wald test.[39]

Data were stratified by sex for all analyses. Statistical significance was set at $p < .05$. Analyses were completed in 2015.

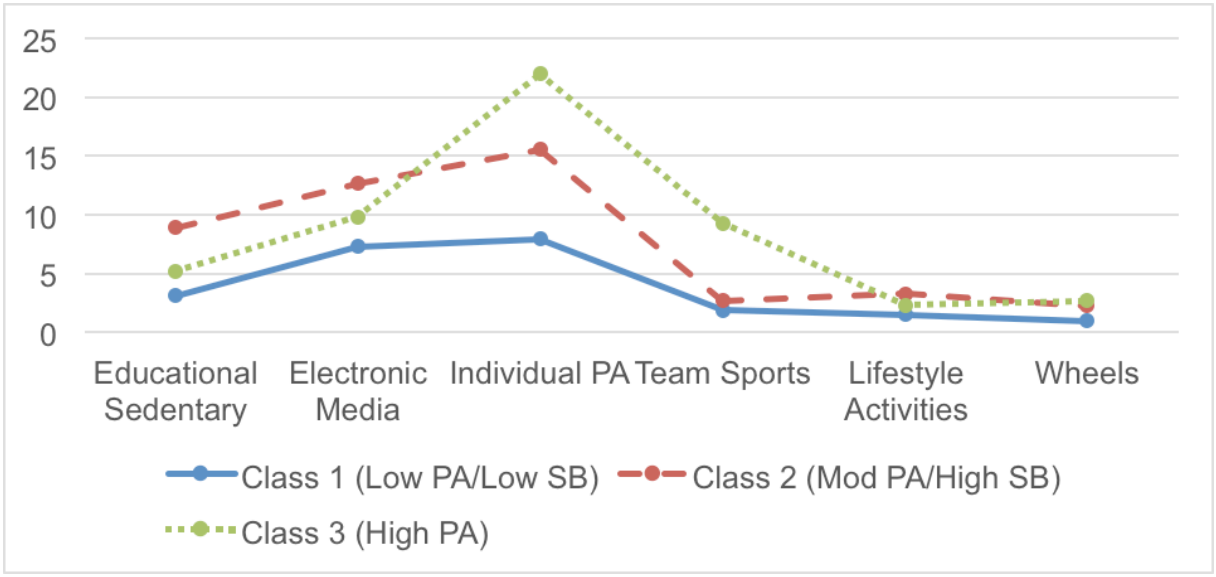
RESULTS

Latent Classes

The final solution yielded a 3-class model for both boys and girls. Classification probabilities for each class were .96, .91, and .94, respectively, for boys, and .93, .88, and .85 for girls. Among boys, Class 1 accounted for the majority of the sample (70.6%) and was labeled "Low Physical Activity/Low Sedentary Behavior" as they reported the fewest mean number of episodes in any activity category. Class 2 included 15.4% of the sample and was distinguished from the other classes as being the "Moderate Physical Activity/High Sedentary Behavior" class. Boys in this class reported relatively high mean number of episodes in educational sedentary, electronic media, and lifestyle activities compared with Class 1. Finally, Class 3 accounted for 14.0% of the sample and was considered the "High Physical Activity/High Sedentary Behavior" class. Boys in Class 3 reported engaging in the most instances of electronic media and educational sedentary, as well as individual physical activities and team sports over the past 5 days compared with the other classes. Figure 1 provides a graphical representation of the patterns of physical activity and sedentary behavior by class for boys.

Three distinct classes among the girls also were identified. Similar to the boys, Class 1 was also the largest group accounting for 54.4% of girls and was characterized as "Low Physical Activity/Low

Figure 2
Patterns of Physical Activity and Sedentary Behavior (Mean Number of Episodes) by Latent Class (Girls N = 274)



Sedentary Behavior." Class 2 included 32.8% of the sample and was distinguished from the other classes as "Moderate Physical Activity/High Sedentary Behavior." Like boys, girls in this class reported the highest mean number of episodes of education sedentary, electronic media, and lifestyle activities. Class 3, which comprised another 12.8% of the sample, was distinguished from the other classes as being "High Physical Activity" with girls reporting the most instances of individual physical activities, team sports, and wheel activities. Unlike Class 3 for boys, Class 3 girls did not experience simultaneously high levels of sedentary behavior in this group. Figure 2 includes a graphical representation of the patterns of physical activity and sedentary behavior by class for girls.

Characterization of Classes by Key Variables

To describe the classes further, Table 1 and Table 2 include demographic and other key variables by class for boys and girls in the 5th grade, respectively. Differences between the classes are presented with both an unadjusted and adjusted p-value. In general, boys in each class did not differ significantly by race, SES indicators, or weight status, nor in other individual-, interpersonal-, or school-level factors. However, boys in Class 3 had higher mean levels of self-efficacy compared with the other 2 classes (Class 3: 3.6[.09] vs. Class 1: 3.3[.05], p = .004; Class 2: 3.3[.09], p = .051) (Table 1).

Compared with boys, girls differed more by class on demographic and other key variables (Table 2). Class 3 girls reported statistically significantly higher levels of enjoyment for physical activity, perceived parental support for physical activity, and home physical activity equipment (ps < .05). Furthermore, Class 3 girls also had significantly higher BMIs compared with girls in Class 1 or Class 2; however, this difference was no longer significant after controlling for race/ethnicity, poverty level, and parent education.

Physical Activity over Time by Class

Figure 3 includes the mean minutes per hour of MVPA over time for each class by sex. In 5th grade, there was no difference between the classes in MVPA for either boys (Wald tests (1) ≤ 1.091, p ≥ .296) or girls (Wald tests (1) ≤ 1.279, p ≥ .258). However, the linear decline (mean, 95% CI) in physical activity between 5th and 7th grades did differ according to class. In boys, there was no decline in MVPA in Class 2 (0.054, -0.116 to 0.224 min/hour), which differed from the decline in Class 1 (-0.288, -0.469 to -0.106 min/hour) (Wald test (1) = 7.220, p < .007). Neither class differed significantly from Class 3 (-0.331, -0.772 to 0.059 min/hr) (Wald tests (1) ≤ 3.140, p ≥ .076). In girls, there were similar declines of MVPA in Class 1 (-0.231, -0.319 to -0.142 min/hr) and Class 2 (-0.159, -0.279 to -0.039 min/hr) (Wald test (1) =0.882, p = .348). There was no decline in Class 3 (0.023, -0.182 to 0.227 min/hour), which differed from Class 1(Wald test (1) = 4.978, p = .026), but not Class 2 (Wald test (1) = 2.258, p = .133).

Table 1
Demographic Characteristic of Boys (N = 221) by Class

Characteristic	Class 1 (N = 156)	Class2 (N = 34)	Class 3 (N = 31)	Unadjusted p-value	Adjusted p-value[a]
Socio-demographics					
Race, %				.07	
Black	43.0	32.4	61.3		
White	30.1	52.9	19.4		
Other	17.3	8.8	12.9		
Hispanic	9.6	5.9	6.5		
Parent education, % ≥high school	60.3	52.9	54.8	.67	
% poverty, M (SD)	16.2 (6.6)	16.5 (6.8)	17.2 (6.5)	.77	
Weight status					
BMI, M (SE)	20.9 (0.5)	19.5 (0.9)	19.5 (0.9)	.15	.14
Overweight/Obese, %	47.4	41.2	32.3	.28	.25
Individual-level factors					
Self-efficacy, M (SE)	3.3 (.05)	3.3 (.09)	3.6 (.09)	.01	.01
Enjoyment, M (SE)	3.5 (0.5)	3.5 (.09)	3.7 (.10)	.44	.46
Perceived PA barriers, M (SE)	1.7 (0.4)	1.6 (.08)	1.5 (.08)	.13	.14
Perceived parent support for PA, M (SE)	3.4 (.08)	3.3 (.17)	3.7 (.18)	.12	.22
Interpersonal-level factors					
Parent support for PA, M (SE)	3.0 (.09)	2.8 (.15)	3.0 (.16)	.45	.71
Sports/physically active lessons in past year,% yes	70.1	72.4	83.5	.36	.44
Screen devices in bedroom, M (SE)	1.5 (.08)	1.5 (.16)	1.2 (.17)	.31	.18
Home PA equipment, M (SE)	6.4 (.27)	5.9 (.48)	6.7 (.52)	.48	.19
Neighborhood safety, M (SE)	3.1 (.08)	2.7 (.18)	3.0 (.19)	.11	.31
School-level factors					
School index, %	43.0	44.1	29.0	.33	.46

Note.
BMI = body mass index; PA = physical activity; M = mean; SE = standard error; SD = standard deviation, Parent ed. = parent education; [a]adjusted analyses controlled for race/ethnicity, % poverty, and parent education.

DISCUSSION

The major finding from this study is that 3 distinct classes of physical activity and sedentary behavior were identified in both 5th grade boys and girls, and select individual- and interpersonal-level factors differed between the classes. Specifically, "High Physical Activity" girls who reported the most episodes of team and individual physical activities also had significantly higher levels of enjoyment of physical activity, parent support for physical activity, and physical activity equipment at home than girls in the other classes. The "High Physical Activity/High Sedentary Behavior" boys also had higher levels of self-efficacy for overcoming barriers to physical activity than Class 1 boys. Previous studies have reported an association between self-efficacy, enjoyment, parent support, and equipment and physical activity in children.[40-45] However, this is one of the first studies to demonstrate these relationships according to overall patterns of physical activity and sedentary behavior using a latent class approach with multiple putative determinants of behavior.

Whereas the solution yielded a 3-class model for both boys and girls, Class 3 looked different by sex. That is, Class 3 girls were characterized by "High Physical Activity" whereas Class 3 boys were characterized by "High Physical Activity/High Sedentary Behavior." This pattern of high physical activity combined with simultaneously high levels of sedentary behavior has been documented previously in children, particularly among boys.[16,46]

Table 2
Demographic Characteristics of Girls (N = 274) by Class

Characteristic	Class 1 (N = 149)	Class 2 (N = 90)	Class 3 (N = 35)	Unadjusted p-value	Adjusted p-value[a]
Socio-demographics					
Race, %					
Black	42.	30.7	25.7	.34	
White	35.6	40.9	48.6		
Other	15.4	15.9	17.1		
Hispanic	6.7	12.5	8.6		
Parent education, % ≥ high school	54.4	55.6	45.7	.59	
% poverty, M (SD)	16.6 (8.2)	16.4 (6.9)	15.4 (6.0)	.26	
Weight status					
BMI, M (SE)	22.3 (0.4)	20.8 (0.6)	23.1 (0.9)	.03	.08
Overweight/Obese, %	53.0	41.1	54.3	.17	.32
Individual-level factors					
Self-efficacy, M (SE)	3.2 (0.5)	3.2 (.06)	3.4 (.10)	.06	.07
Enjoyment, M (SE)	3.5 (0.5)	3.4 (0.6)	3.7 (0.9)	.02	.02
Perceived PA barriers, M (SE)	1.7 (.04)	1.7 (.05)	1.7 (.08)	.94	.88
Parent support for PA, M (SE)	3.2 (.07)	3.3 (.10)	3.9 (.15)	.001	.001
Interpersonal-level factors					
Parent support for PA, M (SE)	2.8 (.08)	2.6 (.10)	3.0 (.15)	.07	.08
Sports/physically active lessons in past year, % yes	62.9	57.5	71.4	.39	.35
Screen devices in bedroom, M (SE)	1.2 (.09)	1.1 (.11)	1.3 (.16)	.47	.56
Home PA equipment, M (SE)	5.9 (.23)	6.1 (.29)	7.4 (.47)	.02	.02
Neighborhood safety, M (SE)	3.0 (.11)	3.2 (.13)	3.1 (.19)	.12	.08
School-level factors					
School index (High School Resources), %	51.7	36.7	45.7	.08	.07

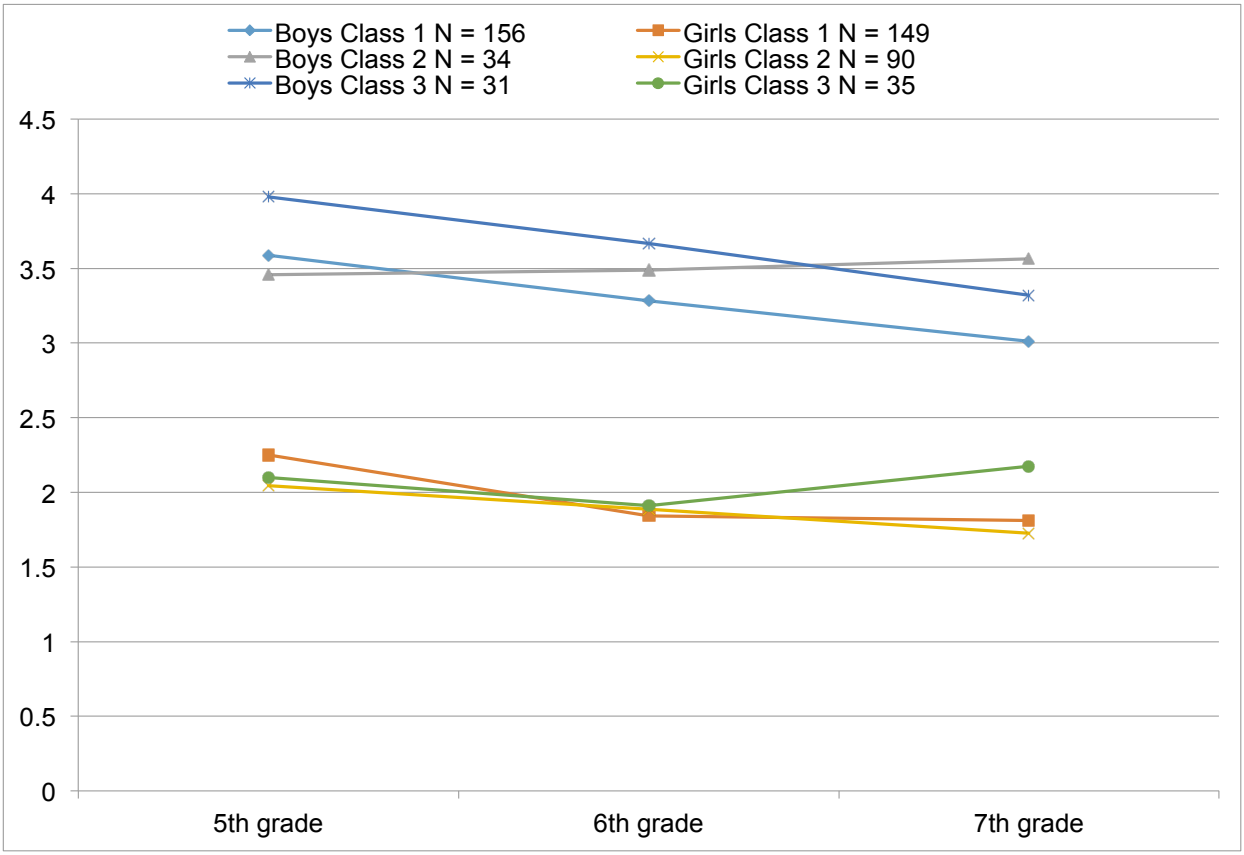
Note.
BMI = body mass index; PA = physical activity; M = mean; SE = standard error; SD = standard deviation, Parent ed. = parent education; [a]adjusted analyses controlled for race/ethnicity, % poverty, and parent education

This suggests that sedentary time does not necessarily replace physical activity in some children. Furthermore, interventions designed to increase physical activity in school-aged children may benefit from approaches that target electronic media in boys as a way to increase physical activity.

Despite different patterns of sedentary and physical activity behaviors reported in 5th grade, this did not result in statistically significant different levels of objectively measure physical activity in 5th, 6th, or 7th grade. However, although the absolute differences may not appear large (~.5 minutes/hour), summed together across the weeks and years, they could contribute to a marked difference in total minutes of physical activity over time. More noteworthy, perhaps, is that whereas most children had a decline in minutes of physical from the 5th through 7th grades, small classes of boys and girls did not decline. That is, Class 2 boys (Moderate Physical Activity/High Sedentary Behavior) and Class 3 girls (High Physical Activity) did not decrease their levels of MVPA over time. There is little understanding of the relationship between classes of behavior in 5th grade and the influence on physical activity during ensuing years. More research on children's physical activity in the transition from elementary to middle school is warranted.

The majority of boys and girls (70.6% and 54.4%, respectively) were classified as engaging in few episodes of both physical activity and sedentary behavior in the past 5 days. A previous cross-sec-

Figure 3
Minutes per Hour of Moderate-to-Vigorous Physical Activity over Time for Each Class by Sex



tional study involving a large sample (N = 12,538) of 9-14 year-old children in 9 European countries found a similar behavior pattern (low physical exercise/low sedentary behavior) in the majority of girl participants.[46] Interestingly, these girls also had the second lowest proportion of overweight of any other group (the high physical exercise/low sedentary behavior group had the lowest levels). It is possible that these children are spending more time in activities not captured in the current survey. It is also possible that only a few physical activities and sedentary behaviors dominated their leisure time, thereby giving the appearance of low engagement. Future studies should explore the frequency and duration of a range of activities for children in this developmental stage, and the contribution of specialized versus broad engagement in activities to overall physical activity levels.

Strengths of this study include a relatively diverse sample of 5th grade children, and the objective measurement of physical activity to examine changes in physical activity by latent class in the transition from elementary to middle school. This study is limited by the relatively small sample sizes of children in Classes 2 and 3. Furthermore, the relationship between classes and other relevant community/societal factors is unknown as we did not assess them.

This study uniquely contributes to the literature by providing information about the association of overall patterns of physical activity and sedentary behavior (latent classes) in 5th grade boys and girls with key variables across levels of the socioecological model of health behavior. Many previous studies were limited in that they only examined associations with individual-level factors or demographic variables, potentially leaving out other important, modifiable factors that would be valuable for intervention development. Including these key social and physical environmental factors in multi-level approach to physical activity promotion will increase the likelihood of effectiveness. Of particular interest would be the characteristics of those children in the High Physical Activity class, so that public health professionals and practitioners have a better idea of which modifiable factors

can be targeted to increase physical activity for each sex. Specifically, this study found that children in the High Physical Activity class also had higher levels of self-efficacy (boys), and enjoyment, parental support, and physical activity equipment at home (girls). These findings underscore the potential importance of self-efficacy for overcoming barriers (boys) and home environment (girls) in shaping patterns of physical activity in school-aged children. Future studies should explore additional characteristics of children (eg, community, societal factors) within these patterns of activity to inform future interventions and help children meet national physical activity guidelines.

Human Subjects Statement

The Institutional Review Board at the University of South Carolina approved all protocols.

Conflict of Interest Statement

All authors of this article declare they have no conflicts of interest.

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