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Personal, Behavioral, and Socioenvironmental Correlates of Physical Activity Among Adolescent Girls: Cross-Sectional and Longitudinal Associations

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Abstract

Background—Physical activity (PA) declines sharply and rapidly during adolescence, especially among girls, posing a risk for inactivity and obesity in adulthood. This study identified personal, behavioral, and socioenvironmental correlates of concurrent and 6-month longitudinal PA among adolescent girls.

Methods—Data were gathered from 356 adolescent girls (mean age 15.8 ± 1.2 years; > 75% racial/ethnic minorities) in the Minneapolis/St. Paul area in 2007–2009. Linear regression analyses controlling for age, race/ethnicity, and school were conducted predicting baseline and follow-up levels of total PA and moderate-to-vigorous PA (MVPA) assessed via 3-Day Physical Activity Recall. Models were fit for each correlate individually and for all correlates together, mutually adjusted.

Results—For concurrent PA, significant positive predictors when adjusting for the influence of all other variables included self-efficacy, support from friends and teachers, and friends' PA. Total screen time and distance from school to PA resources related inversely to concurrent PA. In mutually-adjusted models, 6-month PA was positively related to self-worth, family support, and parent PA and inversely related to total screen time.

Conclusions—PA interventions with adolescent girls might be enhanced by involving adolescents' social networks and also by helping adolescents feel better about their self-worth and athletic abilities.

Keywords

adolescence; exercise; predictors; females

Individuals who regularly engage in physical activity (PA) are less likely to develop chronic diseases including heart disease and cancers and are less likely to become overweight compared with their sedentary counterparts.¹ The substantial evidence of health benefits from PA led the Centers for Disease Control and Prevention to recommend that youth engage in at least 60 minutes of moderate-to-vigorous physical activity (MVPA) per day.² In addition to disease prevention, PA promotes enhanced memory and cognitive performance,³ higher energy levels,⁴ improved mood,⁵ and higher quality sleep.^{5,6} These cognitive and behavioral benefits of PA underscore its importance for adolescents whose academic success depends upon cognition, memory, and having sufficient energy levels to learn and retain sizable quantities of diverse information.^{7,8}

Despite the importance of engaging in regular PA during adolescence, rates of PA drastically decline during this life stage, especially among girls.^{9,10} While 35% of girls aged 6–11 in the United States meet the recommended levels of PA, among 12- to 15-year-old girls, only 3% achieve the recommendation.¹⁰ Although adolescent boys also experience declines in PA, rates of PA among boys are higher at each age compared with girls. For example, 48% of 6- to 11-year-old boys and 12% of 12- to 15-year-old boys meet PA recommendations.¹⁰

Recently, several school-based interventions have attempted to increase PA among sedentary and overweight adolescent girls (see Brown & Summerbell¹¹ for review) but have had mixed success. One way to improve the potential for success of future programs like these is to identify and intervene on modifiable personal, behavioral, or socioenvironmental factors associated with both adolescent girls' PA levels and change in PA over time. If predictors of the PA decline seen during adolescence can be identified and effectively targeted, it may be possible to slow, stop, or even reverse the trend of activity reduction during the high school years.

Although research in the field of adolescent PA suggests that personal, behavioral, and socioenvironmental factors are all related to PA,^{12–16} there is considerable inconsistency in the literature regarding magnitude and even direction of the relationships between many of these variables and PA.¹⁵ It is important that researchers clarify the nature of these relationships through longitudinal studies. It is especially important to identify and understand the factors that contribute to PA among those adolescent girls at highest risk for inactivity and overweight later in life (ie, those who are currently inactive, overweight, and of racial/ethnic minority status), as physical inactivity tends to track from adolescence into adulthood.^{17,18}

Given the importance of identifying correlates of PA to guide interventions as well as the lack of consistency in the literature regarding personal, behavioral, and socioenvironmental factors that contribute to PA among adolescent girls, the current study aims to identify cross-sectional and longitudinal correlates of PA in adolescent girls at risk for inactivity and obesity. Both total PA and MVPA were assessed in the current study because both have demonstrated relationships with obesity among adolescents (see¹⁹ for recent review) and both may have other additional health benefits.¹ Furthermore, striving for increases in total PA may be more feasible than for increases in only MVPA among a currently sedentary

population. Potential PA correlates were theoretically driven, with variable selection guided by Social Cognitive Theory²⁰ (see Figure 1). It was hypothesized that all variables would be positively associated with PA except for self-consciousness during PA, distance to PA resources, television (TV) use, and screen time, for which inverse relationships with PA were hypothesized. Results of the current study can inform future intervention efforts aimed at reversing the trend for sharp decreases in PA among adolescent girls, especially among those at greatest risk of becoming sedentary and overweight adults.

Methods

Study Design

Data for the current analysis were drawn from an evaluation study of New Moves, a school-based intervention aimed at preventing weight-related problems in adolescent girls. The program was evaluated in a school-based group-randomized trial at 12 high schools in the Twin Cities area (Minneapolis/St. Paul, MN). Participants in both the intervention and control schools were enrolled in all-girls physical education classes during the first semester of the 2007 or 2008 school year. The intervention and its evaluation are described in detail elsewhere.²¹ All study procedures were approved by the University of Minnesota's Institutional Review Board as well as each of the participating school districts. Participants provided both written assent and consent from a parent/guardian. Baseline data were collected either in late spring or early fall, before the start of the fall class. Physical activity, personal, behavioral, and social variables were assessed again at the end of the 1-semester class (ie, at 6-month follow-up); environmental variables were assessed at only 1 time point. Ninety-seven percent of participants completing baseline assessments also completed the follow-up evaluation.

Study Population

Participants were recruited via fliers and posters in the schools as well as through a description of the program in each school's catalog. All recruitment materials were designed to attract girls who were inactive, felt uncomfortable in traditional coeducational physical education classes, and were interested in experiencing new types of PA in a noncompetitive all-female environment.²¹ Following the recruitment period, 356 participants enrolled in the all-female physical education courses. The sample was racially/ethnically diverse: 28% were African American or black, 24% were white, 23% were Asian American, 14% were Hispanic or Latina, and 10% were mixed or other race. Average participant age was 15.8 years, with a range of 14–20. Nearly half of the participants were classified as overweight (18%) or obese (28%) based on the CDC growth charts for age and gender.^{22,23}

New Moves was advertised to all girls in the schools and made available to any interested girl who participated in less than 1 hour of physical activity per day and who did not report any eating disordered behavior. Recruitment materials were designed to appeal to sedentary girls who felt uncomfortable being physically active but who had a desire to be healthier. In addition to being interested in participating, girls also needed the approval of the school's guidance counselors, who determined whether the girls were able to fit the class into their schedule around other required classes. In some of the schools, physical education teachers

also provided input on whether the girls would be a good fit for New Moves (for example, by excluding those who already were very physically active or played varsity sports). Four girls were ineligible due to high self-reported levels of physical activity. Three girls reported interest, but refused baseline assessments. Seventy additional girls attempted to enroll, but were unable to do so due to scheduling conflicts with required classes.

Measures

Personal-level variables assessed included adolescent perceptions of athletic competence, appearance, self-efficacy to overcome PA barriers, benefits of PA, enjoyment of PA, and self-consciousness during PA. Additional personal variables that were assessed were self-worth and body satisfaction, given that individuals with higher perceptions of self-worth are more likely to engage in behaviors (including PA) that demonstrate greater care for self²⁴ and those with greater body satisfaction are more likely to be physically active.²⁵ Behavioral variables included TV viewing, total screen time, making time for PA, and goal setting for PA. Socioenvironmental variables included support for PA from family members, friends, and teachers, as well as perceived and objectively measured access to PA opportunities. Environmental access to PA resources was measured objectively using Geographic Information Systems (GIS; ArcGIS, ESRI, Redlands, CA). Locations of participant residences and schools as well as parks, gyms, and walking/cycling trails in the neighborhoods were placed onto GIS maps facilitating the calculation of the shortest street-network distance from each participant's school and residence to PA resources. Addresses were provided by the girls at baseline data collection and verified at each additional data collection. If an address changed between data collection points, the new address was updated in the database to ensure that the GIS data reflected each girl's current address. All personal, behavioral, and socioenvironmental measures evaluated as possible correlates of PA are described in detail on Table 1.

The 3-Day Physical Activity Recall (3DPAR) was used to assess both physical activity and sedentary activities (TV viewing, and total screen time); the 3DPAR is an appropriate tool for assessing both screen-based activities²⁶ and physical activities^{27,28} among an adolescent female population. When completing the 3DPAR, each participant reported her predominant activity for every 30-minute block of time between 6:00 AM and midnight on the 3 days before completing the assessment. A list of 65 common activities was provided and participants selected activities from this list or specified other activities if their predominant activity during a 30-minute block was not listed. Each participant was also asked to record whether her exertion level during any physical activities undertaken was light, moderate, hard, or very hard. Activities were then converted into metabolic equivalents (METs) using the compendium of physical activities^{29,30} and grouped to calculate the average daily 30-minute blocks spent in total PA and in MVPA (ie, those activities at an intensity of 3 METs or greater). The 3DPAR had a 2-day test-retest reliability of $r = .71$ for MVPA.³¹

Data Analyses

Primary data analyses were performed in 2010–2011 using SAS statistical software, release 9.1 (SAS Institute, Cary, NC, USA) and consisted of linear regressions modeled with 4 separate outcome variables: baseline total PA, baseline MVPA, follow-up total PA, and

follow-up MVPA. For analyses with baseline total PA and baseline MVPA as outcomes (ie, cross-sectional analyses), explanatory variables included all of the baseline personal, behavioral, and socioenvironmental variables assessed. For analyses with follow-up total PA and follow-up MVPA as outcomes (ie, longitudinal analyses), explanatory variables were change scores calculated by subtracting the baseline value from the follow-up value for every variable assessed both at baseline and follow-up (ie, all personal, behavioral, and social variables). In all regression analyses, models were adjusted for participant age and race/ethnicity, and school was included as a random effect. Longitudinal analyses were additionally adjusted for baseline values of the outcome variable being examined (ie, either total PA or MVPA) and study condition.

One set of regression models was fit with each explanatory variable in a separate equation to examine its relationship with PA without statistically controlling for the effects of other explanatory variables. Another set of regression models was fit with all explanatory variables included together to assess these variables' unique contributions to PA in the presence of each other. In these latter models, relationships between the explanatory and outcome variables were tested using backward elimination³² with manual selection of the variable to be removed next (based on the highest remaining *p* value) to simplify the regression model until only contributors with *P* values less than 0.05 remained.

All variables were standardized, allowing for comparison of effect size across the explanatory variables. To transform regression coefficients into interpretable units (ie, amount of time devoted to various activities), beta values and standard deviations for statistically significant correlates of PA were used to calculate the number of units of each explanatory variable associated with 1 additional 30-minute block of daily PA or MVPA. To quantify the explanatory power of the predictor variables on PA, estimates of the percent of variance (R^2) in each PA outcome explained by the PA correlates (ie, personal, behavioral, and socioenvironmental variables) in the mutually-adjusted models were calculated by subtracting the R^2 in the base model (with only the covariates) from the R^2 for the final model remaining following backward selection of explanatory variables. For computational reasons, school was not included in models estimating R^2 .

Results

Cross-Sectional Analyses

At baseline, girls reported engaging in an average of 4.5 30-minute blocks of total PA per day, including 3.0 blocks of MVPA. Several personal, behavioral, and socioenvironmental characteristics were associated with girls' baseline levels of total PA and MVPA, after adjustment for race/ethnicity, age, and school (Table 2). For both total PA and MVPA, self-efficacy to overcome barriers to PA and enjoyment of PA were the strongest correlates ($\beta = 0.70$ – 1.03 , *P* values < 0.001). Total screen time was also related to both total PA and MVPA, with greater time spent engaging in screen-based activities associated with less time spent being physically active. Additional variables positively associated with total PA at baseline included enjoyment of PA and teacher support for PA. Parent participation in PA was positively associated with adolescents' MVPA. Objectively measured distance between participant's school and PA resources was inversely associated with girls' MVPA. For

example, girls whose schools were determined via GIS to be located farther away from PA resources reported less time engaging in MVPA compared with those whose schools were closer to parks, gyms, or trails.

In the regression models predicting baseline total PA and MVPA, which mutually-adjusted for all potential PA correlates, self-efficacy to overcome barriers to PA remained significantly, positively associated with both total PA and MVPA at baseline. Total screen time was a strong, inverse correlate of both total PA and MVPA. Translating the regression coefficients into a more readily interpretable metric, time, (ie, blocks of 30 minutes, as seen in the measure of PA included in this study, the 3DPAR), approximately 1 30-minute block less screen time was related to 1 block more total PA and approximately 2 blocks less screen time related to 1 block more MVPA.

In addition, teacher support for PA and friend PA were positively related to total baseline PA, friend support for PA was positively related to baseline MVPA, and objectively measured distance between participants' school and PA resources was inversely related to MVPA. Together the variables that remained in the final model following backward selection of the explanatory variables most strongly related to total PA accounted for 14.3% of the variance. Similarly, 13.5% of the variance in MVPA was explained by the remaining group of personal, behavioral, and socioenvironmental variables.

Longitudinal Analyses

At follow-up, girls reported an average of 3.8 blocks of total PA and 2.5 blocks of MVPA. Mean values for personal variables targeted in the intervention showed small increases from baseline to follow-up, and most of the behavioral and socioenvironmental variables assessed at both time points remained stable (see Table 1 for baseline and follow-up means for all variables). Results of the regression analyses examining associations between change in each personal, behavioral, and social environmental variable and girls' total PA and MVPA at follow-up, adjusted for baseline levels of physical activity, are presented in Table 3. The 2 change variables most strongly associated with total PA longitudinally were change in family support for PA and change in perceived self-worth. Both of these associations were positive, such that girls who experienced more positive relative changes (ie, larger increases or smaller decreases) in these areas during the study period also showed more positive relative changes in total PA. For MVPA, the largest regression effects were for change in parent PA and perceived self-worth, again both in the positive direction.

In the mutually-adjusted model, increases in self-worth and family support remained significantly predictive of girls' total PA at follow-up, adjusted for baseline levels of physical activity. Similarly, increases in self-worth and parent PA were associated with higher levels of MVPA at follow-up, adjusted for baseline levels of physical activity, while increases in screen time were associated with lower levels of both total PA and MVPA at follow-up, adjusted for baseline levels of physical activity. Together the variables in the final models accounted for 4.4% of the variance in total longitudinal PA and 4.2% of the variance in longitudinal MVPA.

Discussion

The goal of this study was to identify factors related to concurrent and 6-month longitudinal PA among adolescent girls at high risk of becoming sedentary, overweight adults. For both cross-sectional and longitudinal analyses, several personal, behavioral, and socioenvironmental factors were associated with girls' PA. In the mutually adjusted models, which identify those variables that contribute uniquely to PA, screen time was consistently inversely associated with both cross-sectional and longitudinal PA. In addition, self-efficacy to overcome barriers to PA and perceived self-worth were personal correlates positively linked to both total PA and MVPA. Thus, screen time, self-efficacy to overcome PA barriers, and perceived self-worth were identified as the highest-leverage variables on which to intervene among those factors assessed in the present research.

Other variables identified as important factors to target include socioenvironmental variables like support from family members, friends, and teachers, PA participation by close others (friends and family), and objectively measured distance from school to PA resources. In addition to what was observed in the mutually-adjusted analysis, the individual linear regression models suggest that some variables (eg, athletic competence, friend support for PA) relate to PA and may be fruitfully addressed within interventions that do not target factors explaining shared variance in PA. Many of the variables identified as statistically significant predictors of total PA and/or MVPA in the individual models were not identified as significant predictors in the mutually adjusted models, suggesting shared variance between predictors retained and excluded from the final models. Thus, the presentation of unadjusted models in addition to the adjusted models is particularly valuable considering that most interventions do not act on all types of variables assessed in this study (eg, altering the physical environment may not always be possible).

Findings from the current study that perceived athletic competence, parent support, support from others, and opportunities to exercise, were positively associated with adolescents' PA align with what was observed by Sallis and colleagues¹⁵ in their review of socioenvironmental correlates of adolescents' PA. In addition, several explanatory variables cross-sectionally related to both total PA and MVPA in the current study (ie, friend PA, total screen time, and self-efficacy to overcome barriers to being active) aligned with prior research of factors related to PA among young people in both the U.S. and other countries (eg,^{13,33–35}). In our own prior analyses of factors associated with change in PA among a different sample assessed during development of New Moves,¹⁴ factors associated with change in PA over time included self-worth and support for PA from parents, 2 of the variables identified in the present analyses as longitudinal correlates of PA. Finally, consistent with effect sizes reported in previous investigations of factors related to adolescent PA,^{36–38} associations between physical environmental factors and PA were smaller in magnitude than the associations between many of the personal, social, and behavioral variables and PA.

Present findings suggest that PA among at-risk adolescent girls is related to a variety of factors and that intervention efforts aimed at increasing PA among this age group would benefit from considering contributors of many types. The present results also suggest that it

is important to consider how changes in social and personal factors over time relate to PA longitudinally, and that targeting change in some of these areas (eg, social support, perceptions of self-worth, and perceived athletic competence) may help to promote PA among adolescent girls. Meanwhile, other potential foci of PA interventions (eg, setting PA goals) did not demonstrate predictive value longitudinally in the current study, and may not be the highest leverage factors to target when aiming to increase PA among adolescent girls.

The current study makes a contribution to the literature by identifying specific personal and socioenvironmental cross-sectional and longitudinal predictors of PA among adolescent girls at high risk for becoming sedentary, overweight adults. A particular strength of this study is that over 75% of the participants were from racial/ethnic minorities; these girls represent populations typically underrepresented in research and overrepresented in terms of overweight/obesity and concomitant health problems. An additional strength was the inclusion of theoretically-derived constructs assessing personal, behavioral, and socioenvironmental factors, including both subjective (self-reported perception) and objectively measured (via GIS) assessments of environmental access to PA resources.

Along with these study strengths, there are also limitations to address. On average, PA declined from baseline to follow-up in this study, possibly due to the fact that follow-up assessments were done following the first semester of the school year, (ie, in the midst of a cold Minnesota winter.) With few participants increasing PA over the study period, recommendations for intervening on specific personal, behavioral, or socioenvironmental factors based on this study would be most appropriate for interventions seeking to minimize PA declines among this population rather than to produce PA increases over time. We acknowledge that effects may be different within each ethnic group; however, we did not have the power to analyze each ethnic group separately in this study. Future research may shed additional light on this issue by gathering samples that would allow testing ethnicity as a moderator. In addition, participants' schools were not included as neighborhood physical activity resources, unless for example, the green space next to a school was a distinct park space. This exclusion of schools could have resulted in underestimating PA resources if any participants used their schools for leisure-time physical activities.

Finally, the collection of most environmental measures at only 1 time point precluded the assessment of how change on these measures relates to change in PA; however, given the short time frame of this study, it is unlikely that distance to PA resources from most girls' homes or schools changed. Further, the primary advantage of longitudinal data over cross-sectional data are the ability to assess directionality; with physical environmental links to PA, the direction of influence is much more likely to be that the environment affects PA than it is the girl's PA is affecting the environment. Nevertheless, the lack of follow-up environmental data precludes an examination of whether change in perceived or measured distance to resources is associated with changes in PA. Future research in the area of predictors of longitudinal change in PA would benefit from assessing the manner in which naturally occurring environmental changes relate to adolescents' change in PA over time.

Inconsistencies in predictors of PA across studies and the low percentage of variance in PA explained by the predictors included in the current study underscore the existence of many

unanswered questions regarding factors correlated with PA among youth and the best factors to address within interventions; however, the present results can inform future interventions aiming to increase PA among adolescent girls at high risk for becoming sedentary, overweight adults. Such interventions may benefit from working with members of the adolescent's social network, especially family members, to both increase their own PA and to promote and encourage PA by the targeted adolescent. In addition, such interventions should incorporate efforts to help participants feel better about both their overall self-worth and their ability to be physically active. Physical activity participation provides opportunities for adolescents to learn and take pride in what their bodies can do and can lead to increased perceptions of physical competence.³⁹ Specifically, increasing perceptions of athletic competence can be accomplished via greater availability of options and mastery experiences in a physical activity context⁴⁰ and can also lead to increased feelings of self-worth and esteem;⁴¹ thus, safe environments with multiple physical activity outlets and achievable challenges that foster athletic success among adolescent females could constitute important intervention components. Providing girls with a supportive environment in which girls of all sizes, shapes, and skill levels can be active and can participate in open discussions with other girls can help in improving both perceptions about athletic competence and overall feelings of self-worth. Indeed, in the New Moves program, which provided such a supportive environment, intervention girls showed significantly larger increases in both perceived athletic competence and self-worth compared with girls in the control condition.

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Table 1

Personal, Behavioral, and Socioenvironmental Variables Assessed

Variable	Description of assessment	Observed range	Baseline mean (SD)	Follow-up mean (SD)	Psychometric properties
Personal					
Athletic competence	Five questions assessing perceived athletic competence as compared with other teenagers. ⁴²	5–20	11.7 (3.0)	12.1 (3.0)	Test/retest $r = .88$ Cronbach $\alpha = .73$
Appearance	Five questions assessing perceived physical appearance as compared with other teenagers. ⁴²	5–20	13.1 (4.0)	13.5 (3.7)	Test/retest $r = .75$ Cronbach $\alpha = .86$
Self-worth	Five questions assessing global self worth as compared with other teenagers. ⁴²	5–20	14.8 (3.4)	14.8 (3.2)	Test/retest $r = .78$ Cronbach $\alpha = .79$
PA self-efficacy	Six questions assessing perceived ability to engage in physical activity in the face of obstacles like stress and mood. ¹⁴	6–30	18.1 (5.7)	18.8 (5.3)	Test/retest $r = .78$ Cronbach $\alpha = .79$
Benefits of PA	Five questions assessing perceived benefits of being physically active (eg, more energy, stress management). ¹⁴	5–20	14.1 (2.6)	14.5 (2.5)	Test/retest $r = .70$ Cronbach $\alpha = .68$
Enjoyment of PA	Four questions assessing how enjoyable participant finds physical activity (eg, “Physical activity is fun.”). ¹⁴	4–16	11.4 (2.6)	11.8 (2.3)	Test/retest $r = .76$ Cronbach $\alpha = .80$
Self-conscious during PA	Four questions assessing participant self-consciousness surrounding physical activity (eg, “I get embarrassed if other kids see me being physically active.”).	4–16	11.6 (2.9)	11.9 (2.8)	Test/retest $r = .74$ Cronbach $\alpha = .83$
Body satisfaction	Ten questions assessing satisfaction with weight, height, and specific body parts; Adapted from Body Shape Satisfaction Scale ⁴³ and Body Cathexis Scale. ⁴⁴	10–60	36.1 (12.7)	38.3 (12.2)	Test/retest $r = .84$ Cronbach $\alpha = .92$
Behavioral					
TV viewing	Self-reported 30-minute blocks of daily television viewing (from 3DPAR).	0–16	2.6 (2.7)	2.7 (2.6)	
Total screen time	Self-reported 30-minute blocks of daily television viewing, Internet/ computer use, video games, and DVD/ video viewing (from 3DPAR).	0–17	3.8 (3.2)	3.8 (3.1)	
Make time for PA	Four questions assessing participant’s willingness and ability to make time for physical activity (eg, “Physical activity takes too much time”). ¹⁴	4–16	11.1 (2.3)	11.1 (2.2)	Test/retest $r = .85$ Cronbach $\alpha = .65$
Goal setting for PA	Three items regarding planning ahead for PA, setting PA goals, and setting aside time for PA.	3–15	8.1 (2.9)	8.5 (2.9)	Test/retest $r = .83$ Cronbach $\alpha = .83$
Socioenvironmental					
Social environment					
Family support for PA	Five questions on family support for physical activity (eg, “During a typical week, how often has a member of	5–25	13.2 (4.8)	13.0 (4.9)	Test/retest $r = .81$ Cronbach $\alpha = .83$

Variable	Description of assessment	Observed range	Baseline mean (SD)	Follow-up mean (SD)	Psychometric properties
Friend support for PA	your household encouraged you to do physical activities or play sports? ^{a)} One question: "Many of my friends help me to be physically active" (Adapted from ⁴⁶).	1–4	2.3 (1.0)	2.3 (0.9)	Test/retest $r = .65$
Teacher support for PA	One question: "At my school there are teachers or other school staff who encourage me to be physically active" (Adapted from ⁴⁷).	1–4	2.5 (0.8)	2.7 (0.8)	Test/retest $r = .76$
Parent PA	Two questions "My mother/father is physically active." (Adapted from ⁴⁶)	2–8	4.8 (1.7)	4.8 (1.7)	Test/retest $r = .87$ Cronbach $\alpha = .65$
Friend PA	One question: "Many of my friends are physically active" (Adapted from ⁴⁶)	1–4	2.8 (0.9)	2.7 (0.9)	Test/retest $r = .75$
Physical environment					
Perceived neighborhood crime	One question regarding neighborhood crime (ie, "It is safe to walk or jog in my neighborhood."; Adapted from ⁴⁸).	1–4	3.1 (0.8)	NA	
Neighborhood safe for walking	One question regarding walking safety participant's neighborhood (ie, "It is safe to walk or jog in my neighborhood."; Adapted from ⁴⁸).	0–4	3.0 (0.8)	NA	
Self-reported PA access (home)	Four yes/no questions assessing participant's perception of whether PA resources (ie, nearest park, trail, public gym, private gym) were within walking distance of her home.	0–4	2.1 (1.0)	NA	
Self-reported PA access (school)	Four yes/no questions assessing participant's perception of whether PA resources (ie, nearest park, trail, public gym, private gym) were within walking distance of her school.	0–4	1.9 (1.0)	NA	
Measured distance to PA access (home)	Average distance (meters) from participant's home to nearest park, trail, public gym, and private gym measured via Geographic Information Systems (GIS).	567–3430	1719 (512)	NA	
Measured distance to PA access (school)	Average distance (meters) from participant's school to nearest park, trail, public gym, and private gym measured via Geographic Information Systems (GIS).	804–2600	1616 (476)	NA	

^a Access to all survey items and scales included in New Moves survey available at www.newmovesonline.com.

^b The New Moves survey was originally tested with 48 adolescents for overall comprehension and item/scale psychometrics, including 2-week test-retest of variables. Cronbach's values are from the final sample of 356; test-retest values are from the original sample.

Table 2
Baseline Correlates of Baseline Total (PA) and Moderate-to-Vigorous Physical Activity (MVPA)^a

Explanatory variable (measured at baseline)	Total PA at baseline				MVPA at baseline			
	Individual models ^b		Mutually adjusted model ^c		Individual models ^b		Mutually adjusted model ^c	
	β	P	β	P	β	P	β	P
Personal								
Athletic competence	0.57	0.004			0.38	0.020		
Appearance	0.04	0.840			-0.05	0.770		
Self-worth	0.11	0.565			0.01	0.935		
PA self-efficacy	0.99	< 0.001	0.80	< 0.001	0.71	< 0.001	0.53	< 0.001
Benefits of PA	0.84	< 0.001			0.60	< 0.001		
Enjoyment of PA	1.03	< 0.001			0.70	< 0.001		
Self-conscious during PA	0.41	0.040			0.26	0.110		
Body satisfaction	-0.01	0.983			-0.05	0.785		
Behavioral								
TV viewing	-0.69	< 0.001			-0.53	< 0.001		
Total screen time	-0.94	< 0.001	-0.80	< 0.001	-0.66	< 0.001	-0.56	< 0.001
Make time for PA	0.24	0.209			0.29	0.062		
Goal setting for PA	0.67	< 0.001			0.59	< 0.001		
Social environment								
Family support for PA	0.65	< 0.001			0.55	< 0.001		
Friend support for PA	0.70	< 0.001			0.59	< 0.001	0.41	0.008
Teacher support for PA	0.72	< 0.001	0.49	0.007	0.48	0.002		
Parent PA	0.55	0.004			0.51	0.001		
Friend PA	0.69	< 0.001	0.45	0.013	0.56	< 0.001		
Physical environment								
Perceived neighborhood crime	-0.09	0.636			-0.05	0.765		
Neighborhood safe for walking	0.06	0.767			0.04	0.797		
Self-reported PA access (from home)	0.43	0.032			0.27	0.100		
Self-reported PA access (from school)	0.34	0.095			0.25	0.116		

Explanatory variable (measured at baseline)	Total PA at baseline				MVPA at baseline			
	Individual models ^b				Mutually adjusted model ^c			
	β	<i>P</i>	β	<i>P</i>	β	<i>P</i>	β	<i>P</i>
Measured distance to PA access (home) ^d	-0.09	0.661			-0.04	0.792		
Measured distance to PA access (school) ^d	-0.21	0.423			-0.34	0.032	-0.36	0.029
Final <i>R</i> ²		NA		0.180		NA		0.172
Base <i>R</i> ²		NA		0.037		NA		0.037
<i>R</i> ²		NA		0.143		NA		0.135

^aBased on multiple linear regression models adjusted for race/ethnicity and age. School was included as a random effect.

^bEach predictor run in its own regression equation (controlling for race/ethnicity, age, and school)

^cOnly predictors with *P*-values <0.05 were retained in mutually adjusted models.

^dDistance determined by the shortest street network a participant could walk or drive from her residence or school to PA amenity (ie, park, trail, public gym, private gym).

Table 3

Change () in Personal, Behavioral, and Social Environmental Variables Predicting Follow-Up Total (PA) and Moderate-to-Vigorous Physical Activity (MVPA)^a

Explanatory variable (change from baseline to follow-up)	Total PA at follow-up				MVPA at follow-up			
	Individual models		Mutually adjusted model ^b		Individual models		Mutually adjusted model ^b	
	β	P	β	P	β	P	β	P
Personal								
Athletic competence	0.37	0.020			0.26	0.055		
Appearance	0.04	0.788			-0.06	0.620		
Self-worth	0.39	0.010	0.33	0.031	0.32	0.012	0.27	0.036
PA self-efficacy	0.14	0.347			0.19	0.135		
Benefits of PA	0.06	0.679			-0.09	0.497		
Enjoyment of PA	0.14	0.374			0.07	0.584		
Self-conscious during PA	0.10	0.528			-0.02	0.862		
Body satisfaction	0.20	0.197			0.18	0.155		
Behavioral								
TV viewing	-0.19	0.209			-0.15	0.256		
Total screen time	-0.34	0.024	-0.32	0.034	-0.30	0.020	-0.27	0.032
Make time for PA	0.08	0.593			0.02	0.905		
Goal setting for PA	0.20	0.188			0.11	0.406		
Social environment								
Family support for PA	0.44	0.004	0.39	0.012	0.30	0.020		
Friend support for PA	0.29	0.057			0.31	0.017		
Teacher support for PA	0.03	0.832			0.01	0.952		
Parent PA	0.30	0.044			0.33	0.010	0.29	0.024
Friend PA	0.20	0.175			0.21	0.091		
Final R^2	NA		0.196		NA		0.194	
Base R^2	NA		0.152		NA		0.152	
R^2	NA		0.044		NA		0.042	

^aBased on multiple regression analysis with models adjusted for race/ethnicity, age, condition, and baseline level of physical activity. School was included as a random effect.

^b Only predictors with P -values < 0.05 were retained in mutually adjusted models.