Winter 2-1-2002

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Preventive Medicine **34,** 266–278 (2002)
doi:10.1006/pmed.2001.0982, available online at http://www.idealibrary.com on IDEAL®

Psychosocial Correlates of Physical Activity and Sedentary Leisure Habits in Young Adolescents: The Teens Eating for Energy and Nutrition at School Study[1]

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Background. **Low levels of physical activity (PA) and highly sedentary leisure habits (SLH) in youth may establish behavioral patterns that will predispose youth to increased chronic disease risk in adulthood. The purpose of this paper was to examine associations of demographic and psychosocial factors with self-reported PA and SLH in young adolescents.**

Methods. **A general linear mixed model predicted self-reported PA and SLH in the spring from demographic and psychosocial variables measured the previous fall in 3798 seventh grade students.**

Results. **PA and SLH differed by race, with Caucasian students reporting among the highest PA and lowest SLH. Perceptions of higher academic rank or expectations predicted higher PA and lower SLH. Depressive symptomatology predicted higher SLH scores but not PA. Higher self-reported value of health, appearance, and achievement predicted higher PA and lower SLH in girls. Girls who reported that their mothers had an authoritative parenting style also reported higher PA and lower SLH.**

Conclusions. **Determinants of PA and SLH appear to differ from each other, particularly in boys. Development of effective programs to increase PA and/or decrease SLH in young adolescents should be based on a clear understanding of the determinants of these behaviors.**

Key Words: **exercise; adolescence; predictors.**

INTRODUCTION

The dramatic increase in prevalence of obesity and type 2 diabetes in America's youth is difficult to explain, but national surveillance data suggest that low levels of physical activity (PA) and highly sedentary leisure habits (SLH) are implicated in these trends [*1–4*]. In addition to the immediate health risks that face the adolescent, inactivity and highly sedentary leisure habits during youth may establish behavioral patterns that will predispose youth to adult obesity or other chronic disease risk later in life [*5–12*].

While the International Consensus Conference on Physical Activity in Adolescents recommends a minimum of 20 minutes of moderate to vigorous PA three times per week [*13*], data from the 1999 Youth Behavioral Risk Survey indicate that one-third of high school students do not meet this recommendation [*14*]. Healthy People 2010 includes a goal to increase the proportion of adolescents who engage in vigorous PA three or more days per week for 20 minutes or more to 85% of U.S. children and adolescents; it is estimated that 64% of children and adolescents currently meet this goal [*15*]. Although PA and SLH have been reported to have independent determinants [*16,17*], both low PA and high television viewing time (the most common SLH) have been associated with the development of obesity [*4*]. The American Academy of Pediatrics advises limiting television viewing time to 2 h per day or less in children and adolescents [*18*] and Healthy People 2010 includes a goal to increase the proportion of children who view television 2 or fewer hours per day to 75%. It is estimated that 60% of children and adolescents currently meet this goal [*15*].

Physical activity declines as youth transition from childhood into adolescence. There is some evidence that

[1] This research was supported by a grant from the National Cancer Institute, 5R01 CA71943-03.

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0091-7435/02 $35.00

this decline starts prior to puberty [*19,20*] and strong evidence that the decline continues throughout junior high and high school [*14,15,21*]. However, we know very little about why this decline occurs or what factors are associated with PA in youth. Few studies have assessed demographic and psychosocial determinants of PA and SLH in young adolescents [*22*]. Moreover, data on determinants of PA in youth are particularly sparse in some demographic subgroups including girls and non-Caucasian youth [*22*]. A better understanding of the correlates of PA and SLH in adolescents is important to developing effective intervention strategies for instilling lifelong healthy PA and leisure time habits.

The purpose of this paper is to examine associations of personal, social, and demographic factors with self-reported PA and SLH in a diverse cohort of young adolescents using data from an ongoing study of seventh and eighth graders. Physical activity and sedentary leisure habits were considered distinct outcomes because of previously published evidence that they are distinct behaviors with independent determinants [*16,17*] and because in the data used for this analysis, the correlation coefficient for PA and SLH was −0.04 at baseline and −0.08 at the second measurement time point.

In addition to studying demographic factors as potential predictors of PA and SLH, we also had the opportunity to examine depressive symptomatology, spirituality, future expectations, and parenting style as potential predictors. Demographic variables (including age, ethnicity, and socioeconomic status) have been shown in previous research to be predictive factors for PA and SLH [*6,22,23*]. Depressive symptomatology, spirituality, future expectations, and parenting style have been emerging as predictive factors related to other adolescent health behaviors, including substance use and smoking [*24–30*]. We hypothesized that these factors may influence PA and SLH as well. Because PA, SLH, and psychosocial issues may differ by gender during adolescence [*29,31,32*], we chose to conduct the analysis separately for boys and girls.

METHODS

Design

The Teens Eating for Energy and Nutrition at School study is a school-based group-randomized trial to reduce cancer-related dietary risk behaviors among young adolescents in the Twin Cities, Minnesota [*33*]. The goal of the Teens Eating for Energy and Nutrition at School study is to design and evaluate school-based environmental, classroom, and family interventions to increase fruit and vegetable intake and decrease fat intake in seventh and eighth graders. The Teens Eating for Energy and Nutrition at School study was designed to be implemented with a lower income population, and only school districts with a minimum of 20% of students approved for free or reduced-price meals were eligible. Schools also had to have seventh and eighth graders in the same building and enroll at least 30 students per grade.

Sixteen schools in the Twin Cities area were randomized within pairs matched on enrollment and participation in the free and reduced-price lunch program to intervention or comparison (delayed intervention) conditions after all baseline measures were taken. Baseline surveys were administered to all seventh grade students in the fall semester of 1998. Most students were surveyed on the primary day designated for their school, with a small fraction completing the survey during a repeat visit a week or two later. We spent 1 day in each school and administered the survey in all sections of a course selected by the principal as a required course. The course varied from school to school, but at each school we conducted the survey throughout the day, in each section of a selected required class. Of the 4050 seventh graders eligible for the survey, 95 (2.4%) were missed due to absence from school on both survey attempts, 77 (1.9%) were excluded due to parental or student refusal, and 3878 (95.8%) completed the survey. The age range of participants was 11 to 15 years (mean = 12.8) at baseline. Parents received a letter approximately 2 weeks prior to the survey that detailed the purpose and content of the survey; they were asked to contact the survey coordinator or their child's principal if they had questions or did not want their child to participate. Questionnaires were prepared in advance so that the student's name and study ID number were printed on the cover page and a form ID number only was printed on the first survey page and all subsequent pages. The cover page was removed once the surveys were distributed, so that no one could link the student's name to their answers without access to the master file linking the study IDs and the form IDs; that file was available only to the data manager and the survey coordinator. Students and parents were advised that student responses would remain confidential and that no one outside the project staff would have access to the students' answers. These consent and survey procedures were approved in advance by the University of Minnesota Committee on the Use of Human Subjects in Research. A second round of survey measurements was conducted in participating schools during the spring semester of 1999, and again, all students in the seventh grade were invited to participate. Of the 4033 seventh graders eligible for the survey, 131 (3.2%) were missed due to absence from school on both survey attempts, 104 (2.6%) were excluded due to parental or student refusal, and 3798 (94.2%) completed the survey.

Variables of Interest and Their Measure

Outcome variables: PA and SLH. The primary endpoints for this study were PA and SLH. We created a PA score based on the answers to two questions. First we asked respondents whether they were physically active (outside of school) three times a week for at least 20 minutes at a time; possible responses ranged from "most of the time" to "never" on a 5 point Likert scale. Next we asked participants to think about how hard they worked when they were physically active by thinking about how hard they breathed, with responses ranging from "breathing much harder than usual" to "breathing the same as usual" on a 4 point Likert scale. These questions have been used in previous research with adolescents and were found to be sensitive to detecting intervention effects and effective in assessing tracking of PA behaviors in youth [*21*,*34*]. We combined these two items to form a 0- to 9-point scale where higher numbers represent greater amounts of PA; the scoring algorithm is available on request. The PA scale had a test–retest correlation of 0.65 in our population [*35*]. The SLH score was based on four items that asked about time spent watching television and playing video games on weekdays and on weekends, with a total score ranging from 4 to 20; higher scores represent greater sedentary leisure time. The SLH scale had a test–retest correlation of 0.81 and a Cronbach's alpha of 0.73 in our population [*35*].

Demographic and socioeconomic status (SES) variables. Sex and date of birth came from school records with date of birth then used to compute the age of the student. Students reported race/ethnicity by self-report to the question "Do you think of yourself as White; African American; Hispanic/Latino; Asian or Pacific Islander; Native American; Multiracial; or Other?" Students reported whether they participated in the free or reduced-price meal program at school, the number of parents with whom they lived, the highest level of education for mother and father, and the number of parents who worked full time.

Depressive symptomatology. The 20-item Center for Epidemiologic Studies Depression Scale (CES-D) was used to assess depressive symptomatology [*36*]. The CES-D has been used successfully with adolescents [*27*,*28*]. It provides a score of 0 to 60 with higher scores indicating more depressive symptoms [*36*]. The CES-D had a test–retest correlation of 0.82 and a Cronbach's alpha of 0.84 in our population [*35*].

Spirituality. We adapted a scale from the Voice of Connecticut Youth Survey [*37*] to measure students' perceptions of how much their spiritual or religious beliefs influence their health behaviors. The original scale included items related to fighting, alcohol and drug use, selection of friends, and use of free time. The six-item scale produces values ranging from 0 to 12 and higher scores indicate that the student perceives greater spiritual or religious influence on their health behaviors. The scale had a test–retest correlation of 0.72 and a Cronbach's alpha of 0.84 in our population [*35*].

Future expectations. We also assessed outlook for the future (future expectations) using four items adapted from the Voice of Connecticut Youth Survey. In adolescents, high future expectations are associated with school achievement, better social relationships with peers, and less depression [*30*]. The scale asked respondents "On a scale from 'No Chance' to 'It will happen', what do you think the chances are that you will [OUTCOME]?" The outcomes queried included: (A) live to 35; (B) get HIV or AIDS; (C) be a parent by 18; and (D) ever get in trouble with the police. We added the last two outcomes to the originally published future expectations scale. The scale has a score range of 4 to 20 and higher scores suggest greater future expectations. The future expectations scale had a test–retest correlation of 0.62 and a Cronbach's alpha of 0.51 in our population [*35*].

Parenting style. We also included a group of measures of authoritative versus nonauthoritative parenting developed by Jackson et al. [*24*,*25*]. From research originating in the child development literature, an authoritative parenting style is one that balances parental responsiveness and control. An authoritative parent sets clear boundaries for the child while remaining responsive to the child's needs and rights. This parenting style has been found to foster child competence, self-esteem, and academic achievement [*24*]. In contrast, a nonauthoritative parent is characterized as intrusive and controlling, providing little support for the child's individuation. Work by Jackson and colleagues [*24*,*25*] found that a nonauthoritative parenting style was associated with adolescent initiation of smoking cigarettes [*24*] and alcohol use [*25*]. These scales include six items each for the authoritative mother and father scales and three items each for the nonauthoritative mother and father scales, each of the four scales was standardized with a mean of zero and standard deviation of 1. These scales had test–retest correlations of 0.56–0.62 and Cronbach's alphas of 0.79–0.89 in our population [*35*].

Value on health, appearance, and achievement scale. A seven-item scale measured the importance students place on health, appearance, and achievement. For example, students were asked to respond on a five-point Likert scale from strongly agree to strongly disagree to statements such as "How well I do in school is very important to me." We wrote questions for this scale using information from our formative assessment [*33*] and the theory of planned behavior [*38*] to guide the

question development. The Cronbach's alpha of this scale in the pilot school was 0.85, and the test–retest Spearman correlation was 0.51 [*35*].

Perceived academic rank and expected educational attainment. Two questions from the Connecticut Youth Survey [*37*] were included to measure self-rating of academic performance and expected educational attainment. The first question was: "Compared to other students your age, what kind of student are you?" Response categories were near the bottom, below the middle, average, above the middle, or one of the best. In our population, the test–retest Spearman correlation was 0.79 [*35*]. The second question was: "What is the most education you expect to finish?" Response categories included less than high school, high school, a variety of postsecondary options, and not sure. We recoded this item into a dichotomous variable reflecting those who expected to finish college versus those who did not. The test–retest kappa for this dichotomous variable was 0.63.

Analysis Methods

The data were derived from a cluster sampling design involving seventh graders at 16 schools. Observations taken from students at the same school are likely to be correlated, due to similarities in daytime activities, having the same instructors, etc. [*39*]. This intraclass correlation reflects a component of variance attributable to the school above and beyond that attributable to individual level factors. It also violates the assumption of independence of errors associated with the most familiar analysis methods, including those based on the General Linear Model [*40*]. We addressed this problem by using analytic methods appropriate to the cluster-sampling design. In particular, we based our analyses on the General Linear Mixed Model [*41*], which is appropriate when there are multiple sources of random variation and all sources are distributed normally, as in our dependent variables. We conducted all analyses using Version 6.12 of SAS/STAT [*42*]. We used SAS PROC MIXED for the analysis and confirmed normal distribution by inspection of residual errors. The output provided results similar to those provided by any linear regression or ANOVA/ANCOVA program, except that the standard errors, confidence intervals, F tests, and P values reflect the extra variation attributable to the schools.

We analyzed the data separately for boys and girls. For the PA endpoint, the initial models included linear and quadratic terms for each continuous independent variable of interest; this included the CES-D, the measures of spirituality and future expectations, the authoritative and nonauthoritative parenting scales, and the value on health, appearance, and achievement scale. This provided an indication of any nonlinear relationship that might exist in the data. Next, we fit a multivariate model including only the demographic variables significantly related to PA ($P < 0.05$). We retained significant demographic variables in a complete multivariate model that also contained all other independent variables of interest and any quadratic terms found to be significant in the preliminary analysis. We removed nonsignificant variables from this analysis ($P > 0.05$) in a stepwise fashion. To aid in interpretation of the coefficients for the continuous variables retained in the analysis, we computed the predicted PA scores for the median value and values at the 10th, 25th, 75th, and 90th percentiles. The same analysis plan was used for SLH.

RESULTS

Baseline Characteristics

Table 1 shows baseline characteristics for the boys and girls included in these analyses. About two-thirds of the adolescent participants were Caucasian. The majority lived with both parents and had at least one parent working outside the home, and most had at least one parent who had completed high school. The mean age of the sample was 12.8 years, the range was 11 to 15 years. There was a wide range of responses to the CES-D, spirituality, and future expectations scales.

Physical Activity

Tables 2 and 3 contain the findings for boys and girls for the demographic and psychosocial variables (respectively). For variables that were significantly related to PA, the results are based on the final sex-specific model; for variables that were not significantly related to PA, the results are based on a model that added back all nonsignificant terms to the final model. We present the findings for both significant and nonsignificant terms for the sake of completeness, but we restrict this discussion to the significant terms.

Predicted PA scores are presented for categories within each predictor; for continuous variables, the predicted PA score for the 10th, 25th, 50th, 75th, and 90th percentiles is given. In boys, PA was significantly higher in Caucasian and multiethnic students compared to Asian and boys who classified their race as "other." PA was also higher in boys who lived in homes where at least one parent was working and homes where a mother was present. We found two other independent variables to be significant predictors of PA in boys: nonauthoritative mother scale and perceived academic rank. The relationship of nonauthoritative mother to PA, in boys, was positive across most of the range of the predictor variable, but turned slightly negative at

TABLE 1

Baseline Characteristics of Boys and Girls

Variable name (range)	Boys		Girls	
	N	%	*N*	%
Race	1960		1885	
Caucasian		66.6		66.9
African-American		11.4		10.9
Asian		6.7		7.3
Multiethnic		5.7		6.5
Hispanic		2.8		2.8
Native American		1.7		1.8
Other		4.9		3.9
Lives with mother	1983		1895	
No		9.4		7.2
Yes		90.6		92.8
Lives with father	1983		1895	
No		26.0		28.0
Yes		74.0		72.0
Use of free or reduced lunch program	1983		1895	
Utilizes program		23.4		23.9
Does not utilize program		76.6		76.1
Number of parents who work full time	1983		1895	
Neither parent		16.8		17.9
One parent		36.7		36.0
Two parents		46.5		45.1
Parents' education level	1983		1895	
Both less than high school		13.0		13.5
One completed high school		19.9		23.7
One complete college		19.3		19.2
Both completed college		21.2		19.3
Do not know or missing		26.6		24.3

	N	Mean	SD	*N*	Mean	SD
Age	1983	12.8	0.4	1895	12.7	0.4
Physical activity (0–9)	1945	5.5	3.0	1862	5.3	3.0
Sedentary activity (4–20)	1915	12.6	3.3	1851	10.3	2.8
CES-D (0–60)	1874	12.7	8.9	1835	14.8	10.4
Spirituality (0–12)	1833	4.3	3.4	1810	4.5	3.3
Future expectations (4–20)	1891	17.2	2.4	1850	17.7	2.3
Standardized authoritative and nonauthoritative, parenting scale[a]						

[a] The authoritative and nonauthoritative parenting scales were standardized to have a mean equal to zero and a standard deviation of 1.0. Sample sizes for questions related to father and mother were 1695 and 1783, respectively.

the upper end of the range. Boys with higher perceived academic rank also reported higher levels of PA.

For girls, we found parents' educational level, authoritative mother scale, value on health, appearance, and achievement scale, and perceived academic rank to be significant predictors of PA in the final model. In general, higher levels of PA for girls were found when girls placed a higher value on health, appearance, and achievement, as well as when girls considered themselves strong students. It is important to note that the authoritative mother scale had a nonlinear relationship to PA for girls. The relationship of authoritative mother to PA was positive and accelerated across the range of the predictor variable.

Sedentary Leisure Habits

Tables 4 and 5 contain the significant predictors of SLH for boys and girls for the demographic and psychosocial variables (respectively) in a format identical to that of Tables 2 and 3. Higher levels of SLH were seen for African-American boys relative to all other ethnic classifications except for Native American boys. In addition, boys who qualified for free or reduced price lunch and had low aspirations for college reported higher levels of SLH. For boys, we found three other variables in the final model to be significant predictors of SLH, including the CES-D, future expectations scale, and the spirituality scale. Depressive symptomology

TABLE 2

Prediction of Physical Activity by Baseline Demographic Variables

Variables	Females	Males
	Predicted means (95% CI)	Predicted means (95% CI)
Age		
10th percentile	5.79 (5.45, 6.13)	5.79 (5.46, 6.12)
25th percentile	5.76 (5.45, 6.06)	5.75 (5.46, 6.05)
50th percentile	5.70 (5.42, 5.99)	5.69 (5.42, 5.96)
75th percentile	5.66 (5.35, 5.96)	5.62 (5.32, 5.91)
90th percentile	5.62 (5.28, 5.96)	5.57 (5.23, 5.91)
Race*		
African-American	5.47 (4.90, 6.04)	5.13 (4.57, 5.70)a,b
Asian	5.01 (4.46, 5.56)	4.40 (3.77, 5.04)a
Caucasian	5.80 (5.55, 6.06)	5.77 (5.49, 6.05)b
Hispanic	4.74 (3.84, 5.64)	5.14 (4.24, 6.04)a,b
Multiethnic	5.72 (5.11, 6.32)	5.93 (5.25, 6.61)b
Native American	4.89 (3.84, 5.95)	5.73 (4.49, 6.96)a,b
Other	5.08 (4.29, 5.87)	4.96 (4.27, 5.65)a
Whether mom is in the home*		
No	5.71 (5.06, 6.36)	5.05 (4.48, 5.62)a
Yes	5.71 (5.42, 5.99)	5.62 (5.36, 5.87)b
Whether dad is in the home		
No	5.75 (5.34, 6.16)	5.45 (5.02, 5.88)
Yes	5.69 (5.40, 5.99)	5.75 (5.46, 6.03)
Number of parents working full time*		
Neither parent	5.30 (4.82, 5.78)	5.06 (4.62, 5.51)a
One parent	5.85 (5.51, 6.19)	5.63 (5.31, 5.95)b
Two parents	5.73 (5.41, 6.04)	5.69 (5.39, 5.98)b
Free/Reduced-price lunch program		
Receives F/R lunch	5.79 (5.38, 6.21)	5.94 (5.53, 6.36)
Does not receive F/R lunch	5.68 (5.39, 5.98)	5.61 (5.32, 5.98)
Parents education**		
Both less than high school	5.85 (5.42, 6.28)a	5.62 (5.11, 6.12)
One completed high school	5.71 (5.37, 6.06)a	5.81 (5.40, 6.22)
One completed college	5.73 (5.37, 6.10)a	5.67 (5.26, 6.09)
Both completed college	5.96 (5.59, 6.32)a	5.57 (5.17, 5.96)
Don't know	5.08 (4.74, 5.44)b	5.74 (5.34, 6.14)
Academic expectation		
Expect to finish college	5.78 (5.49, 6.08)	5.56 (5.19, 5.93)
Do not expect to finish college	5.50 (5.11, 5.88)	5.74 (5.45, 6.04)

Note. Values sharing common superscripts (a,b) are not different at the $P < 0.05$ level.

* Significant at $P < 0.05$ for males.

** Significant at $P < 0.05$ for females.

was positively related to SLH, while the spirituality scale and future expectations were inversely related to SLH.

For girls, age, race, and parents' educational level were demographic factors predictive of SLH. Being Caucasian, Asian or self-classification as other was associated with lower levels of SLH relative to other race categories. African- American girls reported the highest levels of SLH. The youngest girls reported the highest SLH scores. The association between parent education level and SLH is unclear. The data suggest that girls whose parents did not complete high school or with one parent completing college have higher levels of SLH and having both parents with a college education was associated with the lowest levels of SLH. In addition, we found four variables in the final model to be significant predictors of SLH in girls, including CES-D score, the authoritative mother scale, the value on health, appearance, and achievement scale, and perceived academic rank. Similar to the finding in boys, depressive symptomology was positively related to SLH. There was an inverse relationship of the value on health, appearance, and achievement scale, the authoritative mother scale, and the perceived academic rank to SLH in girls.

DISCUSSION

The importance of research on determinants of PA in youth lies in the potential to develop more efficacious PA interventions with the short-term goal of increasing

TABLE 3

Prediction of Physical Activity by Baseline Psychosocial Variables

Variable	10%	25%	50%	75%	90%
Depression					
Females	5.59 (5.26, 5.93)	5.63 (5.32, 5.93)	5.68 (5.40, 5.97)	5.77 (5.47, 6.07)	5.89 (5.49, 6.28)
Males	5.66 (5.34, 5.98)	5.67 (5.37, 5.97)	5.68 (5.41, 5.95)	5.70 (5.41, 5.98)	5.71 (5.35, 6.08)
Future expectations					
Females	5.91 (5.49, 6.33)	5.76 (5.47, 6.05)	5.70 (5.42, 5.99)	5.65 (5.36, 5.95)	5.60 (5.27, 5.93)
Males	5.59 (5.22, 5.97)	5.65 (5.35, 5.94)	5.70 (5.43, 5.97)	5.73 (5.43, 6.02)	5.75 (5.42, 6.09)
Spiritual beliefs influence health					
Females	5.61 (5.26, 5.95)	5.65 (5.35, 5.95)	5.72 (5.44, 6.01)	5.77 (5.46, 6.07)	5.82 (5.47, 6.16)
Males	5.57 (5.24, 5.91)	5.60 (5.29, 5.91)	5.68 (5.41, 5.95)	5.76 (5.46, 6.06)	5.81 (5.45, 6.17)
Authoritative mother***					
Females	5.54 (5.24, 5.84)	5.47 (5.20, 5.74)	5.51 (5.26, 5.76)	5.66 (5.41, 5.92)	5.93 (5.58, 6.28)
Males	5.82 (5.43, 6.20)	5.75 (5.45, 6.05)	5.68 (5.41, 5.95)	5.61 (5.31, 5.92)	5.55 (5.16, 5.93)
Nonauthoritative mother*					
Females	5.72 (5.34, 6.11)	5.71 (5.41, 6.02)	5.71 (5.43, 5.99)	5.70 (5.40, 6.00)	5.69 (5.30, 6.08)
Males	5.47 (5.15, 5.79)	5.60 (5.33, 5.87)	5.68 (5.41, 5.96)	5.70 (5.41, 5.99)	5.52 (5.18, 5.85)
Authoritative father					
Females	5.83 (5.45, 6.20)	5.76 (5.46, 6.06)	5.71 (5.43, 5.99)	5.64 (5.33, 5.96)	5.59 (5.23, 5.96)
Males	5.58 (5.22, 5.94)	5.65 (5.37, 5.93)	5.70 (5.42, 5.97)	5.59 (5.22, 5.97)	5.79 (5.42, 6.16)
Nonauthoritative father					
Females	5.76 (5.39, 6.13)	5.74 (5.42, 6.07)	5.71 (5.43, 5.99)	5.68 (5.37, 5.99)	5.65 (5.25, 6.05)
Males	6.01 (5.60, 6.41)	5.82 (5.52, 6.11)	5.72 (5.45, 5.99)	5.53 (5.22, 5.84)	5.34 (4.92, 5.76)
Value of health, achievement, and appearance***					
Females	5.43 (5.13, 5.73)	5.54 (5.28, 5.79)	5.68 (5.44, 5.92)	5.75 (5.50, 6.01)	5.83 (5.54, 6.11)
Males	5.65 (5.30, 6.01)	5.67 (5.37, 5.96)	5.69 (5.41, 5.96)	5.70 (5.41, 5.99)	5.71 (5.38, 6.03)
Perceived academic rank***	1[a]	2	3	4	5
Females	4.78 (4.33, 5.23)	5.12 (4.78, 5.45)	5.45 (5.21, 5.70)	5.79 (5.55, 6.04)	6.13 (5.80, 6.45)
Males	4.75 (4.29, 5.21)	5.07 (4.72, 5.41)	5.38 (5.12, 5.65)	5.70 (5.44, 5.96)	6.02 (5.69, 6.35)

Note. Tabled values are predicted means and (95% confidence intervals) at the indicated percentiles of the independent variable.

* Significant at $P < 0.05$ for males.

** Significant at $P < 0.05$ for females.

*** Significant at $P < 0.01$ for females.

[a] Perceived academic rank is based on a single question with five possible responses; tabled values are based on the five response levels rather than percentiles.

energy expenditure and long-term goals of establishing an active lifestyle and preventing obesity and other chronic diseases. Two recent obesity prevention intervention studies conducted in school-aged children reported that reduced television viewing time (not increased PA) mediated significant obesity-related treatment effects [*43,44*]. There is also some evidence that differences in low- to moderate-intensity activities of daily living explain the between-person differences in total daily energy expenditure more than moderate to vigorous leisure activities [*45*]. Both of these observations suggest that future interventions to increase energy expenditure in youth may need to focus on decreasing SLH as well as increasing PA. This may be especially true if SLH tracks as well as PA habits from youth to adulthood [*46*]. Therefore, it may be important to establish the determinants of excessive SLH in addition to determinants of PA. The present findings extend those of previous reports on psychosocial correlates of PA in young adolescents by concurrently examining predictors of SLH and PA. Our findings suggest that demographic and psychosocial factors help predict both PA and SLH in girls and boys. The predictors that are most robust are demographic variables including race and measures of SES, as well as students' perception of their academic rank and possible educational attainment.

Our observations regarding the differences in PA and SLH by race agree with observations from the 1999 Youth Risk Behavior Survey, in which a higher percentage of Caucasians reported 3+ sessions of vigorous activity per week and 2 or fewer hours of television viewing per day than other races [*14*]. In our data and the 1999 Youth Risk Behavior Survey report, the differences in SLH by race are most striking in comparing the Caucasian and African-American students [*14*]. Race may be a proxy measure of socioeconomic status and differing access to safe play areas and organized sports activities. It is also possible that differences in

TABLE 4

Prediction of Sedentary Leisure Habits by Baseline Demographic Variables

Variables	Females	Males
	Predicted means (95% CI)	Predicted means (95% CI)
Age***		
10th percentile	10.30 (10.05, 10.55)	12.28 (11.90, 12.66)
25th percentile	10.20 (9.99, 10.41)	12.29 (11.95, 12.63)
50th percentile	10.02 (9.84, 10.19)	12.30 (11.99, 12.62)
75th percentile	9.85 (9.65, 10.06)	12.32 (11.98, 12.67)
90th percentile	9.73 (9.48, 9.99)	12.34 (11.95, 12.73)
Race*,**		
African-American	12.15 (11.61, 12.70)a	13.69 (13.05, 14.34)a
Asian	10.11 (9.57, 10.64)c,d	12.70 (12.01, 13.40)b
Caucasian	9.66 (9.47, 9.86)c,e	12.17 (11.81, 12.53)b
Hispanic	11.12 (10.24, 12.01)b	12.17 (11.17, 13.18)b
Multiethnic	10.48 (9.89, 11.08)b,d	12.63 (11.87 13.38)b
Native American	10.54 (9.49, 11.59)b,d,e	12.91 (11.59, 14.23)a,b
Other	9.84 (9.06, 10.63)c,d	12.31 (11.54, 13.08)b
Whether mom is in the home		
No	9.52 (8.89, 10.14)	12.05 (11.35, 12.74)
Yes	10.02 (9.84, 10.20)	12.33 (12.01, 12.65)
Whether dad is in the home		
No	9.89 (9.54, 10.24)	12.13 (11.65, 12.61)
Yes	10.02 (9.82, 10.21)	12.35 (12.02, 12.68)
Number of parents working full time		
Neither parent	9.93 (9.50, 10.36)	12.45 (11.90, 13.01)
One parent	9.85 (9.60, 10.11)	12.41 (12.02, 12.80)
Two parents	10.10 (9.87, 10.33)	12.19 (11.82, 12.55)
Free/rreduced-price lunch program*		
Receives F/R lunch	10.00 (9.65, 10.36)	12.73 (12.28, 13.19)a
Does not receive F/R lunch	9.98 (9.79, 10.17)	12.29 (11.95, 12.64)b
Parents' education**		
Both less than high school	10.64 (10.24, 11.04)a	12.55 (11.98, 13.11)
One completed high school	9.82 (9.52, 10.13)b,c	12.56 (12.10, 13.03)
One completed college	10.29 (9.95, 10.62)a,d	12.05 (11.58, 12.52)
Both completed college	9.55 (9.22, 9.88)b	12.09 (11.65, 12.54)
Don't know	10.09 (9.77, 10.40)c,d	12.38 (11.92, 12.84)
Academic expectation*		
Expect to finish college	9.92 (9.72, 10.11)	12.21 (11.86, 12.56)a
Do not expect to finish college	10.19 (9.87, 10.50)	12.77 (12.36, 13.18)b

Note. Tabled values are predicted means and 95% confidence intervals. Values sharing common superscripts (a–e) are not different at the $P < 0.05$ level.

* Significant at $P < 0.05$ for males.

** Significant at $P < 0.05$ for females.

*** Significant at $P < 0.01$ for females.

PA and SLH by race reflect different cultural or social norms or expectations for PA and SLH.

Several of our observations lend further credence to the importance of family support and resources in determining PA levels in young adolescent boys and girls. For boys, having a mother in the home and having at least one parent working are associated with greater levels of PA. For girls, the highest levels of SLH are seen when both parents have less than a high school education while the lowest levels of SLH are seen when both parents have completed college. The influence of parental education on PA levels in girls in our sample is difficult to interpret. The only statistically significant difference was between girls who reported not knowing their parent's education level versus all other levels. We have inadequate information to speculate on why this association occurred in our data.

PA levels in children who are still reliant on the family will likely differ according to available family resources. Prior studies have reported that parents transporting children to PA activities after school and paying fees for lessons or providing membership in community sports organizations are all correlated with PA levels in youth [*47*,*48*]. Living in a single-parent home has also been reported to be associated with lower PA and higher television viewing time [*49*]. A report from the National Longitudinal Study of Adolescent Health

TABLE 5

Prediction of Sedentary Leisure Habits by Baseline Psychosocial Variables

Variable	10%	25%	50%	75%	90%
Depression**,†					
Females	9.85 (9.62, 10.09)	9.90 (9.70, 10.11)	9.99 (9.81, 10.16)	10.12 (9.93, 10.31)	10.28 (9.99, 10.58)
Males	12.15 (11.76, 12.55)	12.26 (11.90, 12.62)	12.48 (12.14, 12.82)	12.63 (12.25, 13.00)	12.66 (12.24, 13.08)
Future expectations**					
Females	9.88 (9.51, 10.24)	9.96 (9.77, 10.15)	9.99 (9.82, 10.16)	10.02 (9.82, 10.21)	10.05 (9.80, 10.29)
Males	12.71 (12.30, 13.12)	12.52 (12.18, 12.87)	12.33 (12.00, 12.67)	12.24 (11.89, 12.60)	12.15 (11.76, 12.53)
Spiritual beliefs influence health**					
Females	9.95 (9.69, 10.21)	9.97 (9.76, 10.17)	9.99 (9.82, 10.17)	10.01 (9.80, 10.22)	10.03 (9.75, 10.30)
Males	12.73 (12.34, 13.12)	12.65 (12.29, 13.02)	12.42 (12.09, 12.75)	12.18 (11.82, 12.54)	12.02 (11.62, 12.43)
Authoritative mother†					
Females	10.10 (9.84, 10.37)	10.14 (9.92, 10.36)	10.11 (9.92, 10.30)	10.00 (9.79, 10.20)	9.82 (9.50, 10.13)
Males	12.42 (11.98, 12.86)	12.36 (12.01, 12.71)	12.30 (11.99, 12.62)	12.25 (11.90, 12.60)	12.19 (11.75, 12.63)
Nonauthoritative mother					
Females	9.97 (9.65, 10.29)	9.98 (9.77, 10.19)	9.99 (9.81, 10.16)	9.99 (9.79, 10.20)	10.00 (9.68, 10.32)
Males	12.26 (11.85, 12.67)	12.28 (11.92, 12.63)	12.30 (11.97, 12.62)	12.33 (11.99, 12.68)	12.37 (11.92, 12.83)
Authoritative father					
Females	10.01 (9.71, 10.32)	10.00 (9.80, 10.20)	9.99 (9.82, 10.16)	9.97 (9.75, 10.20)	9.96 (9.67, 10.26)
Males	12.40 (11.99, 12.82)	12.34 (12.01, 12.67)	12.29 (11.97, 12.61)	12.25 (11.90, 12.61)	12.21 (11.78, 12.63)
Nonauthoritative father					
Females	9.83 (9.53, 10.13)	9.88 (9.64, 10.12)	9.98 (9.80, 10.15)	10.07 (9.86, 10.29)	10.17 (9.84, 10.50)
Males	12.40 (11.94, 12.86)	12.34 (12.00, 12.69)	12.32 (12.00, 12.64)	12.26 (11.91, 12.62)	12.21 (11.73, 12.68)
Value of health, achievement, and appearance†					
Females	10.37 (10.11, 10.63)	10.32 (10.09, 10.54)	10.07 (9.88, 10.25)	9.86 (9.66, 10.06)	9.61 (9.34, 9.88)
Males	12.55 (12.14, 12.95)	12.44 (12.09, 12.79)	12.30 (11.98, 12.61)	12.19 (11.85, 12.53)	12.12 (11.74, 12.49)
Perceived academic rank*,†	1[a]	2	3	4	5
Females	10.43 (9.99, 10.87)	10.27 (9.97, 10.57)	10.11 (9.92, 10.31)	9.95 (9.76, 10.14)	9.79 (9.50, 10.08)
Males	11.73 (11.12, 12.33)	11.95 (11.50, 12.40)	12.17 (11.83, 12.51)	12.39 (12.06, 12.72)	12.61 (12.19, 13.03)

Note. Tabled values are predicted means and (95% confidence intervals) at selected percentiles of the independent variable.

* Significant at $P < 0.05$ for males.

** Significant at $P < 0.01$ for males.

*** Significant at $P < 0.05$ for females.

† Significant at $P < 0.01$ for females.

[a] Perceived academic rank is based on a single question with five possible responses; tabled values are based on the five response levels rather than percentiles.

found higher socioeconomic status (assessed by mother's education level, family income, and lower neighborhood crime level) to be associated with higher PA and lower SLH in adolescents [*50*]. In this context, our observation that use of a free or reduced-price lunch is associated with higher PA and higher SLH in boys is hard to explain. It has been noted that children living in public housing reported greater perceived behavioral control regarding PA than children living in private housing and that this may reflect greater access to federally funded PA programs or reliance on bicycles for transportation [*51*]. The associations of PA, SLH, and family context are likely to be complex because of such influences.

Although girls generally decrease PA levels during adolescence [*14*,*22*], we did not note any association of age and PA in the current study. However, we did observe a decline in the SLH score with age in girls. This is consistent with 1999 Youth Risk Behavior Survey findings that the percentage of girls in ninth to twelfth grades reporting 2 or fewer hours of television viewing daily increased from 51.6 to 70.4%, respectively [*14*]. During years when girls are decreasing their moderate to vigorous PA levels, they also seem to be decreasing their television viewing time.

In addition to the effects of demographics on PA and SLH, we also found that students' perceived academic rank and expectations for higher education predict PA and SLH in both girls and boys. This is consistent with findings from the 1995 Youth Risk Behavior Survey, which reported that low perception of academic performance was associated with low PA level in older adolescents [*51*].

While not as consistent as demographic and education related predictors, the quality of mother's parenting also seems to be influential. Father's parenting style never emerged as a significant predictor. Girls who report that their mothers are responsive to their needs and rights while setting clear expectations for behaviors (authoritative parenting style), in general, report more

PA and engage in lower levels of sedentary behavior. The relationship between parenting style and boys activity levels is more difficult to interpret. Our data suggest that there is no relationship between parenting style and SLH in boys, while PA in boys is associated with nonauthoritative parenting in the mother. It appears that boys who report that their mothers have a a more controlling (nonauthoritative) parenting style had higher levels of PA, except for the 90th percentile of the distribution of PA.

Our finding of no association between elevated depressive symptomatology and PA in young adolescents is contrary to several published studies and reviews on this topic, which fairly consistently support an inverse association between sadness, loneliness, hopelessness, and other depressive symptoms and PA in adolescents [*22*,*52–56*]. The lack of association between depressed mood and PA level may be an indicator of true variability in this association or a commentary on the precision of the PA index used in this study.

We did observe that elevated depressive symptoms in our young adolescent sample were associated with higher levels of television viewing and/or video game playing in both boys and girls. In the only prior study we located that has examined the association between SLH and psychological well-being in adolescents, nonvigorous leisure activity such as playing darts, pool, snooker, billiards, or fishing was positively associated with a psychological malaise scale [*56*]. Further, our data revealed that a lower SLH score was observed in boys who reported that their spiritual beliefs affected health behaviors and boys who scored higher on the future expectations scale. The depressive symptomatology, spirituality, and future expectations scales may all belong to a broader psychosocial domain relating to psychological well-being and outlook.

The recently published 1999 Youth Risk Behavior Survey data indicate that 28.3% of respondents reported feeling sad or hopeless almost every day for 2 or more weeks in a row [*14*] and our data showed that 40% of the girls and 30% of the boys in the sample exhibited elevated depressive symptomatology (unpublished observations). Given the high prevalence of sadness/hopelessness in U.S. youth combined with the high prevalence of television viewing time above the current recommendations of 2 hours or less per day [*14*], it may be that young adolescents who watch excessive television are an important target group for interventions regarding depression prevention and/or treatment.

Higher value on health, achievement, and appearance predicted higher PA and lower SLH in girls, but not in boys. Others have reported concern regarding physical appearance [*29*] and perceived physical attractiveness to be positively associated with PA in adolescent girls but not boys [*31*]. There may be a reciprocal association between attractiveness and PA such that girls who perceive themselves as more physically attractive are more willing to dress in athletic gear and be seen engaged in PA. Conversely, girls who are more physically active may be more comfortable with their bodies and rate their attractiveness higher than inactive girls. We have extended earlier reports with our observation that higher value on health, achievement, and appearance also predicted lower SLH in girls. Assessment of PA, SLH, and perceived physical attractiveness prior to and after a PA and or SLH intervention in adolescent girls might provide further insight into these associations.

Limitations

There are a few important limitations to this study. Even though the PA and SLH scales have acceptable psychometric properties, neither scale was validated against any criterion observational or physiologic variable. Since the primary purpose of the Teens Eating for Energy and Nutrition at School study was to develop and evaluate programs to affect adolescent eating behaviors, resources for validating the measures of PA and SLH were limited, as was space on the student survey for these measures. In addition, our PA and SLH scales were not designed for the purpose of accurately assessing levels, but rather to be used as a ranking tool for comparing student activity levels with other health behaviors and variables of interest. The field continues to struggle to find valid and reliable measures of PA and SLH that can be administered in a short amount of time in groups of adolescents, particularly when other health behaviors are also being assessed [*58*].

The future expectations scale had poor internal consistency. However, we have included it in this report because it is predictive of school achievement, better social relationships with peers, and less depressive symptoms [*30*] and we think it is of interest to report the observed associations with PA and SLH. Further, in our data, the scale appears to measure something distinct, in that the addition of any other measured variable to our models does not cause the observed significant associations to become nonsignificant. At face value, the scale measures a composite construct that is a combination of internally driven hopefulness and a perceived understanding of the social environment in which the student lives. One possible explanation for the poor internal consistency of the scale is that it may not be measuring a latent construct.

The results of these analyses point to a central role of family environment to determining PA and SLH. It is unfortunate that few data were collected on the PA and SLH habits and the PA-related resources of the families of the students. In addition, only individual-level predictors were examined. There is a great need to study environmental-level factors' influence on PA

and SLH [*59*]. Finally, all of our data are self-reported and, therefore, subject to recall bias. Any misclassification of self-reported data is likely to be nondifferential, resulting in bias of reported findings toward the null.

Summary and Conclusions

This analysis was exploratory, using an existing data set, and was theory driven. The predictors evaluated were chosen based on their ability to predict other health behaviors of adolescents. The a priori intent of this analysis was to focus on demographic and psychosocial predictors for PA and SLH in a diverse cohort of young adolescents who share a similar school environment. The present findings are consistent with prior studies regarding the important role of demographics and family in determining adolescent PA [*22*]. Further, our results extend prior research on this topic by concurrently evaluating demographic and psychosocial predictors of PA and SLH in young adolescents. Perhaps one of our most interesting findings was that three significant predictors of higher PA in girls also predicted lower SLH, including a more authoritative mother; higher value on health, appearance, and achievement; and higher perceived academic rank. By contrast, there were no predictors in common for PA and SLH in our sample of boys, which is consistent with a prior report that PA and television viewing time appear to have separate and unique determinants [*16*,*17*]. Predictors common to PA and SLH for girls may mean that it would be easier to intervene on both behaviors in the same intervention in girls than in boys. On the other hand, predictors common to PA and SLH may be more deeply rooted and intractable than factors associated with a single outcome.

Our findings point to the disparities that are seen between the races and by socioeconomic status indicators. In general, being non-white and coming from families with fewer educational and income resources place adolescents at risk for being more sedentary and less active. The socioeconomic disparity might possibly be addressed by providing more opportunities for lower income students to be physically active via community and school-based programs that extend beyond normal school hours. Attention to our parks and recreation centers in lower income neighborhoods is crucial to helping adolescents find active alternatives to sedentary behaviors. Neighborhoods need to be safe so that riding a bike, walking home from school, or playing in the park are reasonable alternatives to television viewing during leisure time.

Our study suggests that other psychosocial factors such as parenting style; depressive symptoms; value on health, appearance, and achievement; and future expectations emerge as statistically significant predictors of PA and/or SLH, controlling for all other factors examined. Understanding the mechanisms of influence and working to develop creative interventions at both the family and adolescent level are important challenges for the field.

ACKNOWLEDGMENTS

The authors thank Stacey Gerlach, Ann Brombach Weinstein, and Bill Baker for their assistance with survey administration and data management.

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