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# Predictors of Moderate-to-Vigorous Physical Activity (MVPA) in African American Young Adolescents

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## Abstract

**Background—**African American adolescents residing in the South are at increased risk for obesity and physical inactivity, yet our understanding of potential influences is limited.

**Purpose—**Using an ecological framework, this study explored multilevel predictors (individual, family, home, and neighborhood environment) of moderate-to-vigorous physical activity (MVPA) among 116 African American adolescents (ages 12–16).

**Methods—**Adolescents and their parents completed self-report surveys for hypothesized predictors. Youth physical activity was measured using accelerometry.

**Results—**In multiple regression models, decreased daily MVPA was associated with female sex ($\beta=-24.27$, $p<0.0001$). Family social support ($\beta=1.07$, $p=0.004$) and adolescent self efficacy for PA ($\beta=6.89$, $p=0.054$) were positively associated with daily MVPA.

**Conclusions—**Adolescent demographics along with family social support and self-efficacy influence younger African American adolescent physical activity. Further exploration of the



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complex interaction of multiple levels of influence is needed to develop appropriate interventions for this vulnerable group.

**Keywords**

Physical activity; Adolescents; African American; Physical inactivity

## Introduction

More than 23 million (nearly 1 in 3) children and adolescents in the United States are overweight or obese (BMI≥ 85th percentile for age and sex) [1, 2]. This rate is at least triple the rate from 40 years ago, and, in part, led to the recent declaration that this generation of children may be the first not to outlive their parents [3]. Child obesity is associated with a myriad of health conditions in youth that are linked to premature mortality and decreased quality of life including high blood pressure, type 2 diabetes, high cholesterol, sleep apnea, depression/low self-esteem, and teasing [4–6]. Further, overweight children are at greater risk of becoming overweight adults [7, 8]. Additional risk factors for adult obesity include increased risk for certain cancers, cardiovascular disease, and orthopedic complications [8–10].

While rates of obesity have increased across sociodemographic populations, low-income and minority youth are at greatest risk [11]. Differences in socioeconomic status (SES) have been suggested as the cause of racial/ethnic disparities; however, recent studies suggest that this relationship is complex [12, 13]. For white youth, higher SES appears to have a protective effect on obesity risk, whereas rates of overweight and obesity among black youth (particularly girls) do not differ by SES [12, 13]. Data further suggest geographical disparities, with overweight and obese children more often residing in southern states [14].

Efforts to reverse childhood obesity trends primarily focus on energy balance [15]. Increasing physical activity (PA) serves to raise levels of energy expenditure and in combination with reduced or stable energy intake, should result in weight loss. Regular PA in youth is associated with improved health and decreased obesity risk [16], more positive self-esteem [17], and improvements in academic performance and cognitive outcomes [18, 19]. Despite the potential benefits, most American youth do not meet recommended levels of PA [20]. Among youth ages 12–15, only 12 % of boys and 3 % of girls met the recommended 60 min of daily PA when measured objectively [20]. Differences by weekday vs. weekend have also been noted in some [21, 22], but not all studies [23]. Further, activity levels decline with age [24] with peak decline from age 15 to 18 years [25].

Disparities by race/ethnicity, sex, income, and geographic region are apparent for PA behaviors. More white than black youth [26] and more boys than girls [20, 25] meet recommendations. Further, youth from high-income households report greater PA than their lower-income peers, though this relationship may be complicated for African American youth [27]. With respect to US region, adolescents residing in the South report the lowest levels of PA [27, 28] and youth from the urban South have higher physical inactivity rates relative other regions and youth in the rural South [29].

Ecological models have been increasingly used to frame the likely multiple levels of influence (individual, social environment, built environment) on physical activity [30, 31]. At the individual level, adolescent demographics (e.g., age, sex, weight status) and self-efficacy have been suggested as influencing youth activity [32, 33]. At the family level, parental demographics (e.g., education, marital status) and social support are linked with activity among adolescent youth [32, 33]. Home environments that support sedentary behaviors such as screen time (e.g., television viewing, computer and videogame use) have been associated with physical activity [34, 35]. Existing literature of multilevel influences on physical activity; however, is limited by the lack of objectively measured physical activity [36] and participant racial/ethnic diversity [37]. A recent review [38] underscores the need to examine social and environmental correlates of adolescent PA among the most vulnerable youth.

With respect to African Americans, social/cultural beliefs may be particularly salient for understanding patterns of PA in youth. For example, purchasing multiple televisions (including for children's bedrooms) may be viewed as a sign of economic attainment, but may also support sedentary behaviors [39]. Further, neighborhood environments that are perceived as unsafe [40, 41] have been suggested as relevant to youth PA. However, counter to expectations, African American youth with access to safe parks did not have greater odds of reduced inactivity in a recent study [42].

To better understand and reverse rising trends in childhood obesity by increasing PA, it is imperative to understand the most salient predictors of activity among groups at highest risk [38, 43]. To that end, this study expands the current literature by examining potential multilevel influences on objectively measured PA for particularly vulnerable youth. This study was designed to identify the demographic and sociocultural predictors of moderate-to-vigorous physical activity (MVPA) among African American young adolescents residing in an urban southern city. Youth ages 12–16 were targeted in this study to better understand how to potentially intervene prior to significant decline in PA.

## Methods

### Setting

The study took place in metropolitan Birmingham, AL, the largest city in the state, where 73.4 % of residents are African American, 52.4 % of adults have been educated beyond high school, 24 % of youth live in single-parent homes, and 32.7 % of households with children have annual incomes below the poverty level [44]. With a history of discrimination and segregation leading to major events in the Civil Rights Movement, recent years have seen significant urban renewal investment including the development of parks and greenways supporting active living.

### Study Sample

African American adolescents aged 12 to 16 years and their parents were recruited using flyers at local recreational centers, churches, community centers, and newspapers and word of mouth advertising. Only children who self-identified as African American and did not

have any physical conditions limiting mobility or ability to engage in MVPA were included in the study. Informed consent was obtained from the parents and adolescents provided their assent to participate in the study. The Institutional Review Board of the University of Alabama at Birmingham approved all study materials and methods. Parents received a $10 gift card for completing parental surveys. Youth received a $10 gift card for completing youth surveys and a $25 gift card for wearing and returning the accelerometer. Incentives were provided to compensate for their time and transportation to participate in this observational study.

## Data Collection

Using a cross-sectional design, we collected self-report data from adolescents and their parents on variables previously linked to physical activity in youth across multiple levels of influence (individual, family, home environment, neighborhood environment) during the 2011 spring semester of school. Adolescents and parents completed self-administered paper surveys individually. A brief description of each measure is below.

### Individual Level

**Adolescent Demographic Characteristics:** Youth provided demographic information such as age, sex, and grade level. In addition, youth height and weight were measured by trained research staff to calculate body mass index (BMI). Height (to the nearest 0.1 cm) was measured without shoes using a portable stadiometer. Weight was measured (to the nearest 0.1 kg) with outer clothing removed using a digital scale. Adolescent weight status was classified as normal (<85th percentile), overweight (85th percentile≥BMI<95th percentile), or obese (≥95th percentile).

**Self-Efficacy:** Self-efficacy for physical activity was assessed using an eight-item instrument [45] focusing on confidence in one's ability to be physically active in spite of common barriers (e.g., weather, social support). The tool has been validated for use with black and white adolescents [45, 46] and has an internal consistency of 0.80 [47]. Items such as: "I can be physically active during my free time on most days" are rated on a five-point Likert-type scale ranging from 1 = *disagree a lot* to 5 = *agree a lot*. A total score was calculated by taking the sum of the eight items and was used for analytic purposes.

### Family Level

**Parent Demographic Characteristics:** Parents provided demographic information such as age, sex, highest level of education, annual household income, and marital status.

**Family Social Support for Physical Activity:** A five-item scale from the Amherst Health and Activity Study [48] was completed by participating parents. They reported the frequency of the following activities in a typical week "watch your child participate in physical activity or play sports", "encourage your child to do sports or physical activity", "provide transportation to a place where your child can do physical activity or play sports", "do a physical activity or play sports with your child" and "tell your child that he/she is doing well in physical activity or sports". Response options included "never", "1–2 days", "3–4 days", "5–6 days" and "everyday". The tool has been used with diverse groups and has

strong psychometric properties with an internal consistency of 0.78 and 1-week test-retest reliability of 0.81 [48].A total score was calculated by taking the sum of the five items and was used for analytic purposes.

### Home Environment Level

**Media Equipment in Home:** Parents completed the media equipment checklist from the Home Environment Inventory for Physical Activity and Media Equipment [49], a self-report inventory of both the availability and accessibility of equipment and other resources that may support family members' participation in activity and sedentary behaviors (e.g., TVs, computers, videogame players). This checklist has been validated with parents of children ages 10–17 from racially/ethnically diverse backgrounds [49]. Validity of the instrument was rated as good to excellent (ICC=0.71 to 0.96) [49]. A sum of all TVs, desktop and laptop computers, and video game players (including handheld) was calculated to include in the data analysis.

### Neighborhood Environment Level

**Perceived Safety:** Parents completed the safety subscale of a questionnaire to assess physical environmental factors and transportation associated with adolescent physical activity [50]. Eight statements were rated on a 5-point Likert-type scale ranging from "strongly disagree" to "strongly agree." Sample items included: "It is safe to walk or jog in my neighborhood" and "There is a lot of crime in my neighborhood." Item-specific reliability for the 8 items ranged from 0.37 to 0.52 when previously used with urban minority populations [50]. A total score was calculated by taking the sum of the eight items and was used for analytic purposes.

### Outcome

**Physical Activity:** Objective measurements of adolescents' physical activity were obtained using Actigraph uniaxial accelerometers (Model GT1M; Actigraph Manufacturing Technology Inc., Pensacola, FL, USA). Accelerometers were initialized with epoch length set at 1 min, consistent with methodology from prior studies of adolescents [20]. At the study meeting, trained research staff demonstrated the use and purpose of the accelerometers. Adolescents were instructed to wear the accelerometers around their waist using an elastic belt for seven consecutive days, including nights and while participating in recreational or sport activities. They were asked to take it off only for bathing or swimming. Youth were also provided a log to record specific activities by day and time. During the week, at least two reminders were sent through text message, email or phone call as per the participants' desired method of contact. At the end of the week, youth returned the logs and accelerometers. Accelerometry data were uploaded and analyzed using ActiLife version 5.0 software. Data were checked for validity (i.e., counts were present for at least 3 days with at least 8 h of recording time per day) and physical activity was calculated according to currently recommended cut-points for light (2 to <4 METs), moderate (4 to 6.9 METs) and vigorous (≥7 METs) physical activity for youth age 6–17 to adjust for higher resting energy expenditure [20]. Logs were coded for activity type using established methodology [51].

### Statistical Analysis

Data were analyzed using SAS 9.2 [SAS Institute Inc., Cary, NC]. Descriptive statistics were generated for all variables to characterize the study sample. Cross tabulations using the $\chi^2$ statistic or ANOVA depending on the measure were generated to examine unadjusted sex differences in sociodemographics, social/cultural factors, and physical activity. The $\chi^2$ statistic detects differences in the categorical variables while ANOVA is used for continuous variables. Multivariate linear regression models were estimated to identify the predictors of physical activity in our study sample. Multivariate linear regression is an appropriate statistical model that captures the continuous nature of each adolescent's physical activity in METs (metabolic equivalent tasks). Multivariate linear regression models were estimated for the following outcomes: (1) average minutes of daily MVPA for the total week, (2) average minutes of daily MVPA for weekday, (3) average minutes of daily MVPA for weekend day, and (4) average minutes of daily weekly MVPA by sex. Prior to estimating the linear regression models, the distributions of the outcome variables were inspected for skewness towards zero which is common with MVPA measures. None of the outcome variables were skewed towards zero, thus no further adjustment was made. Statistically significant bivariate correlation calculations between independent variables and MVPA were selected as independent variables in the regression models. Statistical significance was evaluated at $p<0.05$ for all analyses. Standardized β values are presented.

## Results

One hundred-sixteen adolescents and their parents consented and enrolled in the study. Table 1 shows select demographic characteristics of the sample. There were 54 boys and 62 girls and the mean age of the total sample was 14.0 years (SD=1.34). Boys were slightly older than girls ($p<0.05$). Parents of these youth were well-educated with 84 % reporting at least some college education. Most youth lived in married households (51 %) and 26 % of households had an annual household income making them eligible for free/reduced lunch. Mean daily minutes of adolescent MVPA are presented in Table 1. The mean daily minutes of MVPA for all days of the week was 40.4 (SD=27.5); however, girls had significantly lower levels of MVPA than boys ($p<0.01$).

Mean daily minutes of MVPA also varied by weekday vs. weekend day ($p<0.01$). For the total sample, mean daily MVPA on weekdays was 43.7 (SD=27.0) and mean daily MVPA on weekend days was 37.1 (SD=35.8). Again, girls were involved in significantly less MVPA for both weekdays and weekend days ($p<0.01$). Twenty-three percent of the sample met daily recommendations of MVPA, with nearly three times as many boys than girls meeting this goal ($p<0.01$).

The results of the multivariate logistic regression models for adolescent physical activity are presented in Tables 2 and 3. In the model with average daily minutes of MVPA per week (Table 2), three variables were significant predictors of MVPA. Female sex was a negative, statistically significant predictor of MVPA for the total week ($p<0.0001$). The estimated number of daily minutes spent in MVPA per week decreased by 24.27 min/ day for girls vs. boys. Further, for every one unit increase in family social support, daily MVPA significantly increased by 5.46 min/day ($p=0.006$). Lastly, a unit increase in adolescent self-efficacy

significantly increased daily MVPA by 6.89 min/ day. Adolescent age, parent education, parent marital status, weight status, parental perceptions of neighborhood safety, and media equipment in the home were not significant predictors of mean daily minutes of MVPA for study participants.

There was considerable variability in predictors of MVPA on weekday vs. weekend day models (Table 2). Some of the variables significant in the total week MVPA model were significant for weekday MVPA. Female sex was associated with a significant decrease of 25.69 min of daily MVPA on weekdays ($p<0.0001$). In addition, for each unit increase in family social support daily weekday MVPA significantly increased by 0.86 min/day ($p=0.0164$). On the other hand, adolescent self-efficacy for PA was not a significant predictor of daily MVPA on weekdays. For weekend MVPA, female sex, family social support, and self-efficacy for PA were statistically significant predictors. Being female was associated with a 22.86-min decrease of daily MVPA on weekend days ($p=0.0003$). Further, for every one unit increase in family social support, weekend MVPA significantly increased by 1.28 min/ day ($p=0.013$). Lastly, in this model, a one unit increase in adolescent self-efficacy for PA was associated with an estimated 10.32 increase in daily minutes of weekend PA ($p=0.04$).

With respect to sex-specific models (Table 3), adolescent self-efficacy for PA was the only statistically significant predictor of daily MVPA for boys. For each unit increase of self-efficacy for PA, there was a 16.91-min increase in daily MVPA ($p=0.024$). For girls, family social support was the only statistically significant predictor average daily MVPA for the total week. For every one unit increase in family social support, there was a statistically significant increase of 1.65 min/day of MVPA ($p<0.0001$).

## Conclusions

Nearly two decades since the 1996 Surgeon General's Report on Physical Activity and Health [52], there has been no change in key findings regarding adolescent physical activity. Most youth, in general, fail to meet recommended amounts of physical activity [20]. Further, racial/ethnic minority, particularly black youth, are still less physically active than their white counterparts and boys are more likely than girls to participate in regular physical activity [20, 53]. Moreover, physical activity levels dramatically decline with age [24].

This study was unique in its exploration of multiple levels of potential influence on adolescent physical activity (individual, family, home environment, and neighborhood environment). Prior studies suggest links between these key factors and PA among children and adolescents, however, much of the existing in the literature did not include findings specific to African American younger adolescents living in the South (a segment of the population with particular vulnerability to obesity and physical inactivity).

Many of our findings are consistent with prior studies. We found overall limited physical activity among youth, though findings here are slightly higher than previously reported objectively measured PA with this age group [20]. Mean daily MVPA for the total sample was about two thirds of recommended levels (40.4 min/day), but the mean level for girls was

significantly less (29.4 min/day). Like many other studies [21, 37], our most consistent finding across all models related to higher levels of MVPA for boys than girls. This may in part be explained by differences in types of physical activities youth participated in. Similar to prior studies [37], girls in our study reported engaging in more activities related to personal care, leisure (e.g., shopping), and household chores. Boys, on the other hand, reported more organized school and after-school activities (e.g., marching band, sports). Differences in types of activities correspond to differences in intensity of physical activity and may thus influence levels of MVPA.

Like our study, Rodriguez and colleagues in a study of physical activity among a racially/ethnically diverse sample of adolescents, found that activity was lower during weekends than on weekdays [54]. Findings may support suggestions that youth may get a large proportion of their physical activity during school days and that racial/ethnic minority youth, in particular, may see weekend time as a time for rest and relaxation rather than a prime opportunity to engage in leisure-time activity [55, 56]. Such beliefs may be passed down from parents to youth and are likely linked to historical vestiges in which blacks worked tirelessly 6 or more days per week in labor intense position (e.g., agriculture, other unskilled positions), particularly in the southern states of the US [57, 58].

Our findings are also in-line with work showing statistically significant positive relationships between family social support and physical activity [33]. Like some prior research [59] we found no relationship between home equipment and PA; however, others have shown a relationship between measures of screen time (e.g., media equipment in the home) and adolescent physical activity [60]. Note, however, that previous studies suggest that links between media use and physical activity are stronger for children, tending to weaken in adolescence [34, 61] which may account for limited impact of this variable in our analysis.

Additional findings from the current study contradict prior work. We found no relationship between parent education or parent marital status and physical activity when others have noted a positive relationship for these variables [33]. Part of the lack of findings may be due to the limited variability in this variable in our sample (e.g., most parents had at least some college education and were married). Likewise, in prior studies, concerns about neighborhood safety and/or crime have been associated with decreases in child physical activity in some [62–64], but not all studies [40, 41]. In the current study, there was no association between parental perceptions of neighborhood safety and adolescent physical activity. This inconsistency may be a result of challenges with measurement of this construct including subjective and contextual nature of a participant’s definition of safety.

The current study contributes to the relative dearth of studies exploring multilevel influences on African American adolescent physical activity. Strengths of the study include its grounding in an ecological model, its focus on a particularly vulnerable population, good representation of both girls and boys in the study sample, and use of an objective measure of physical activity (i.e., accelerometry). The study was not without its limitations and these should be considered in interpretation of findings presented. First, the study involved a limited sample size and limited the number of variables we could explore in the multivariate

models to maintain adequate power (0.80). Second, there is a lack of consensus on the optimal observation length of physical activity in adolescents [65]. Among young children, it is clearer that shorter intervals are needed (e.g., 30 s); however, this is not as clear with adolescents. We utilized a longer epoch (1 min) to compare our results with nationally representative data [20] which may have underestimated vigorous activity while overestimating moderate physical activity. Third, data on neighborhood safety and family support were collected from parents. Looking at potential differences in perceptions of these factors by adolescents and their parents and adding objective environmental measures may enhance this line of research. Fourth, this study only assessed child physical activity. Including objective measurement of parental physical activity is warranted in future studies. Fifth, the data collected here were cross-sectional and do not suggest causality. Longitudinal studies of multilevel influences are needed to better understand early antecedents of physical activity later in life. Finally, caution must be used in generalizing findings from this study to other groups. Participants in this study live in a mid-size urban southern city and reside in households with well-educated parents. Findings for youth from smaller or larger urban cities, rural areas, or living in households where parents are less educated may differ from participants in this study.

While this study confirmed some and contradicted other determinants of adolescent physical activity in African American adolescents living in the South, future studies should further explore potential social and cultural influences on physical activity among these youth at highest risk of obesity, physical inactivity, and associated diseases and conditions. There is a need to develop and evaluate more sophisticated theoretical models to better understand and address the complex issues of inactivity among minority youth. An expanded framework, like that proposed by the African American Collaborative Obesity Network [66], recognizes the roles of historical and social factors, cultural values and beliefs, and physical and economic environments in behaviors determining energy balance and may shed more light on stronger predictors of health behaviors among African Americans. Further, innovative interventions that address the relevant contextual variables of African American adolescents are needed to start and sustain efforts to reverse the rising trends of child and adolescent overweight and obesity.

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## Table 1

Characteristics of study participants

| | Total (*n*=116) | Boys (*n*=54) | Girls (*n*=62) |
|---|---|---|---|
| Adolescent age, mean years (SD)* | 14.0 (1.3) | 14.2 (1.3) | 13.8 (1.4) |
| Child weight status | | | |
| Overweight,[a] *n* (%) | 25 (21.6) | 10 (19.6) | 15 (23.1) |
| Obese,[b] *n* (%) | 28 (24.1) | 9 (17.7) | 19 (29.2) |
| Parent education[c] | | | |
| 8th grade or less, *n* (%) | 3 (2.6) | 3 (5.6) | 0 (0.0) |
| Some high school, *n* (%) | 1 (0.9) | 1 (1.9) | 0 (0.0) |
| Graduated high school or GED, *n* (%) | 10 (8.7) | 6 (11.1) | 4 (6.6) |
| Vocational or technical school, *n* (%) | 4 (3.5) | 2 (3.7) | 2 (3.3) |
| Started college, *n* (%) | 41 (35.7) | 19 (35.2) | 22 (36.1) |
| Graduated college, *n* (%) | 31 (27.0) | 13 (24.1) | 18 (29.5) |
| Started post graduate work, *n* (%) | 11 (9.6) | 5 (9.3) | 6 (9.8) |
| Completed post graduate degree, *n* (%) | 14 (12.2) | 5 (9.3) | 9 (14.8) |
| Parent marital status | | | |
| Single, *n* (%) | 35 (30.2) | 23 (42.6) | 12 (19.4) |
| Married, *n* (%) | 59 (50.9) | 25 (46.3) | 34 (54.8) |
| Living together, *n* (%) | 4 (3.5) | 0 (0.0) | 4 (6.5) |
| Separated, *n* (%) | 5 (4.3) | 2 (3.7) | 3 (4.8) |
| Divorced, *n* (%) | 12 (10.3) | 4 (7.4) | 8 (12.9) |
| Widowed, *n* (%) | 1 (0.9) | 0 (0.0) | 1 (1.6) |
| Annual household income | | | |
| ≤$15,000, *n* (%) | 9 (8.1) | 7 (14.6) | 2 (3.2) |
| $15,001 to $30,000, *n* (%) | 18 (16.2) | 10 (20.8) | 8 (12.7) |
| $30,001 to $45,000, *n* (%) | 29 (26.1) | 13 (27.1) | 16 (25.4) |
| $45,001 to $60,000, *n* (%) | 21 (18.9) | 7 (14.6) | 14 (22.2) |
| $60,001 to $75,000, *n* (%) | 9 (8.1) | 3 (46.2) | 6 (9.5) |
| >$75,000, *n* (%) | 25 (22.5) | 8 (16.7) | 17 (27.0) |
| Adolescent mean daily minutes MVPA,[d] (SD) | | | |
| Total week** | 40.4 (27.5) | 54.0 (29.0) | 29.4 (20.7) |
| Weekdays** | 43.7 (27.0) | 57.9 (27.1) | 32.2 (20.7) |
| Weekend days** | 37.1 (35.8) | 50.1 (42.3) | 26.6 (25.3) |
| Adolescents Meeting Daily MVPA[e, **] Recommendations, *n* (%) | 23 (19.8) | 17 (33.3) | 6 (9.2) |

For continuous variables, *t* test was performed to assess differences by sex. For categorical variables, Chi-square tests were performed to assess differences by sex

[a] Overweight (85th percentile≤ BMI<95th percentile)

[b] Obese (BMI≥95th percentile)

[c] Missing data for one female participant

[d] Moderate (4–6.9 METs) and Vigorous (≥7 METs)

[e] Calculated as ≥300 min of MVPA per week (≥60 min/day, 7 days/week)

* $p<0.05$;

** $p<0.01$

**Table 2**

Estimation results of multivariable linear regression models-predictors of adolescent's physical activity, measured using average daily minutes of MVPA

| Variable | Average minutes of daily MVPA total week | | Average minutes of daily MVPA weekdays | | Average minutes of daily MVPA weekend days | |
|---|---|---|---|---|---|---|
| | Estimate | *p* value | Estimate | *p* value | Estimate | *p* value |
| Intercept | 15.6064 | 0.4836 | 30.4654 | 0.1593 | 0.7474 | 0.9809 |
| Adolescent age | −0.0249 | 0.2888 | −0.0377 | 0.0982 | −0.0121 | 0.7140 |
| Sex[a] | −24.2748 | <0.0001 | −25.6861 | <0.0001 | −22.8635 | 0.0003 |
| Parent education[b] | 0.0189 | 0.4192 | 0.1098 | 0.3832 | 0.0180 | 0.5844 |
| Parent marital status[c] | | | | | | |
| Not married | −27.7837 | 0.9825 | 1.6582 | 0.6949 | −1.8487 | 0.7623 |
| Weight status[d] | | | | | | |
| Overweight | 2.7870 | 0.6202 | −2.3335 | 0.6693 | 7.9076 | 0.3168 |
| Obese | −4.6432 | 0.3995 | −6.4102 | 0.2312 | −2.8763 | 0.7102 |
| Neighborhood safety | −0.3683 | 0.4737 | 0.0053 | 0.9916 | −0.7418 | 0.3043 |
| Media equipment in home | −0.0016 | 0.5188 | −0.0033 | 0.1654 | 0.0001 | 0.9674 |
| Family social support | 1.0657 | 0.0037 | 0.8563 | 0.0164 | 1.2752 | 0.0134 |
| Adolescent self-efficacy | 6.8884 | 0.0544 | 3.4582 | 0.3202 | 10.3186 | 0.0402 |

MVPA Moderate-to-Vigorous Physical Activity (≥4 METs)

[a]Reference group = boys

[b]Based on 8 categories ranging from <8th grade to professional degree

[c]Reference group = married

[d]Reference group = normal weight (<85th percentile)

## Table 3

Estimation results of multivariable linear regression models—predictors of adolescent's physical activity by sex, measured using average minutes of daily MVPA

| Variable | Average minutes of daily MVPA total week Boys | | Average minutes of daily MVPA total week Girls | |
|---|---|---|---|---|
| | **Estimate** | ***p* value** | **Estimate** | ***p* value** |
| Intercept | −3.8427 | 0.9308 | 20.9194 | 0.5348 |
| Adolescent age | −0.0394 | 0.1571 | −1.0837 | 0.5084 |
| Parent education[a] | −2.4341 | 0.2454 | 0.0146 | 0.4232 |
| Parent marital status[b] | | | | |
| Not married | −3.6200 | 0.6527 | 1.1703 | 0.7985 |
| Weight status[c] | | | | |
| Overweight | 14.3432 | 0.1563 | −3.4302 | 0.5608 |
| Obese | 0.5193 | 0.9636 | −6.8209 | 0.2273 |
| Neighborhood safety | −0.5124 | 0.5354 | −0.4617 | 0.4465 |
| Media equipment in home | 0.0008 | 0.8072 | −0.0232 | 0.0678 |
| Family social support | 0.3401 | 0.5799 | 1.645 | <0.0001 |
| Adolescent self-efficacy | 16.9064 | 0.0236 | 2.5369 | 0.4483 |

MVPA Moderate-to-vigorous physical activity (≥4 METs)

[a] Based on eight categories ranging from <8th grade to professional degree

[b] Reference group = married

[c] Reference group = normal weight (<85th percentile)