Correlates of Weight-Bearing Physical Activity Among Adolescent Girls: Results From a National Survey of Girls and Their Parents

Simani M. Price, Judith McDivitt, Deanne Weber, Lisa S. Wolff, Holly A. Massett, and Janet E. Fulton

Background: Despite the potential benefits of reducing the risk of osteoporosis in later life, research on adolescent girls' weight-bearing physical activity (WBPA) is limited. This study explores correlates for WBPA in this population. Methods: A nationally representative telephone survey sponsored by the National Bone Health Campaign was conducted with 1000 girls age 9 to 12 years and a parent. Girls' physical activities were coded as weight bearing or not and correlated with cognitive, social, and environmental variables. Results: Regression analysis revealed that WBPA was significantly associated with self-reported parents' education, parental self-efficacy, girls' normative beliefs about time spent in physical activity, being physically active with a parent, having physically active friends, and perceived availability of after-school physical activities. Conclusions: Interventions encouraging parents to participate in WBPA with their daughters and increasing parents' positive attitudes and self-efficacy in getting their daughters to be physically active should be tested.

Keywords: physical activity attitudes, physical activity beliefs

Osteoporosis is a significant public health concern in the United States, with approximately 1.5 million people suffering an osteoporosis-related bone fracture each year. It is estimated that 10 million Americans over age 50 have osteoporosis, and an additional 34 million are at risk for developing the condition. Although osteoporosis is commonly associated with postmenopausal women, childhood and adolescence represent a key period for taking preventive measures. Skeletal maturity occurs during puberty, and engaging in weight-bearing physical activity (WBPA) during this time is a key strategy in building and maintaining healthy bones and reducing the risk of osteoporosis later in life for women. A recent expert panel...
review of relevant research stressed the importance of physical activity (PA) for prepubertal girls and those early in puberty.\textsuperscript{4}

Most literature on PA among youth focuses on moderate and vigorous PA rather than on WBPA.\textsuperscript{4} Despite evidence of PA’s beneficial effects on health, many of these studies suggest that it is common for preadolescents and adolescents to engage in low levels of such activity. Recent surveys indicate that 64\% of all American children age 9 to 13 years do not participate in any organized PA outside of school,\textsuperscript{5} and 33\% of adolescents in grades 9 through 12 do not participate in the minimum recommended amount of moderate or vigorous PA.\textsuperscript{6} Overall, levels of PA decline substantially during adolescence, particularly among girls\textsuperscript{7} in the United States. In addition, girls are less likely than boys to participate regularly in vigorous and moderate PA as they move from preadolescence to adolescence.\textsuperscript{8}

Several demographic, psychosocial, and environmental correlates of girls’ PA have been identified in recent studies.\textsuperscript{9} Race/ethnicity has been found to be a significant demographic predictor in girls, with Whites more likely to be physically active than African Americans or Hispanics.\textsuperscript{10,11} In addition, parents’ education and income have been positively associated with increased PA among girls.\textsuperscript{12-14} Environmental factors such as accessibility of safe areas and availability of sports activities at school,\textsuperscript{11} as well as the availability of parental transportation,\textsuperscript{15} have also been associated with girls being physically active. Even so, a recent review of correlates of PA for adolescent girls found no consistent trend for physical environment.\textsuperscript{9} Psychosocial indicators that have emerged as significant correlates in girls include self-efficacy,\textsuperscript{11,16,17} parental and family support,\textsuperscript{14-18} peer support,\textsuperscript{19} parental modeling,\textsuperscript{12-14} the girl’s enjoyment, and positive expectations for outcomes of PA.\textsuperscript{13} Although research has identified correlates of overall PA among girls, little is known about the prevalence and correlates of WBPA. Indeed, the level of WBPA in children is not known specifically. A study conducted by the National Osteoporosis Foundation, however, estimated that less than half of all American high school–age girls reported doing 3 or more days of strengthening or muscle-toning exercises.\textsuperscript{6} One of the few studies conducted on girls’ WBPA suggests that both family and peer support are related to this activity, and family support was found to be associated with knowledge about WBPA.\textsuperscript{20} In another study, overweight girls reported more barriers to WBPA and less parental support for this activity than did normal-weight girls.\textsuperscript{21}

Additional research is needed to identify and understand the unique correlates for WBPA in girls so as to develop more effective targeted interventions to increase this activity among girls generally. The aim of the current study is to explore correlates of self-reported WBPA for girls age 9 to 12 years by using a nationally representative survey conducted with adolescent girls and their parents that was sponsored by the National Bone Health Campaign (NBHC). (The NBHC is jointly sponsored by 3 organizations: the Health and Human Services Office on Women’s Health, Centers for Disease Control and Prevention, and National Osteoporosis Foundation.) The NBHC survey was developed based on behavioral models from the theoretical and empirical literature on children’s PA. Concepts from social cognitive theory,\textsuperscript{22} the health belief model,\textsuperscript{23} and the theory of reasoned action\textsuperscript{24} were used to develop survey measures of psychosocial, environmental, and demographic correlates in girls and parents. The data for this study are from the NBHC baseline survey, which was conducted before any campaign interventions.
Methods

Participants and Procedure

During a 6-week period between November and December 2001, the NBHC conducted telephone interviews with 2000 girls age 9 to 18 years and with 1 parent of each girl age 9 to 12 (n = 1000 parents). The analyses reported for this study include only girls between 9 and 12 years and the interviewed parent.

The respondents were selected using a “Families With Children” list sample (http://www.experian.com/small_business/pdf/ fall03_catalog_families.pdf) compiled from a White Pages base using many different public and proprietary sources (eg, hospital records, magazines, registries, census data). The list-sample files contained information on household demographics (ie, child’s age and gender, race/ethnicity). Because girls age 9 to 18 years represent a relatively small portion of the national population (girls 10–19 accounted for 7.1% in 2000), the use of a list was preferred over random dialing so as to reduce respondent burden and collect information as efficiently as possible. Oversampling of minority populations (Hispanic and African American girls) was conducted using the household race/ethnicity information included in list files, targeting a minimum of 100 girls from each minority group to ensure adequate samples for statistical analysis.

Telephone numbers were randomly selected from the Families With Children list sample and called up to 7 times. Trained market researchers conducted scripted interviews using computer-assisted telephone interviewing technology. Interviewers first sought a parent’s permission before obtaining the daughter’s consent. Parents provided all demographic information.

Before respondents were called, a total of 15,000 letters were mailed out on Centers for Disease Control and Prevention letterhead to families that had been identified through the database. Surveyors called a total of 13,482 respondents to complete 2000 household interviews. The screener eligibility criteria for the study was having a girl age 9 to 18 in the household. The final status of these calls was as follows:

- Unknown eligibility: (1) 2326 busy signals, no answer, or answering machines; (2) 5697 refused to participate before screener eligibility questions were asked; and (3) 817 requested a callback before eligibility was determined, whereupon subsequent callbacks resulted in busy signals, no answers, or answering machines.

- Known eligibility: (1) 2234 respondents were ineligible (failed screener test), (2) 408 terminated the interview before completion, and (3) 2000 completed the interview.

Using procedures recommended by the American Association of Public Opinion Research, the survey eligibility rate for the sample was 52%. Based on the survey eligibility rate, the survey response rate was 29%, and the survey cooperation rate was 83%. Eighty-three percent of the eligible households (N = 2000) completed the interview.
Instrument

Multiple measures of each concept in the model were identified in the existing literature, qualitative one-on-one in-person cognitive-assessment interviews were conducted with girls and their parents to ensure comprehension and clarity of the instrument, and the instrument was then pretested using 50 telephone interviews. This process resulted in substantial revisions to the final instrument.

Outcome Variable: WBPA

To assess WBPA, girls were asked a series of questions about their participation in activities throughout the week and weekend. PA was defined as doing a sport or other active things (eg, rollerblading, walking, or running) that increase heart rate and sweating. The questions addressed time spent being physically active in gym class and at recess, involvement in sports teams, enrollment in PA classes (eg, swimming, tennis), and participation in unstructured physical activities after school in the past week and during the past weekend. Each PA was coded as either weight bearing or not weight bearing by consensus of the study authors, because no standardized reference for WBPA has been published. Weight-bearing behaviors (eg, jumping rope) were deemed to exert significant gravitational force on the body. Our classification of activities as weight bearing (eg, jumping rope) or not weight bearing was consistent with previous research that measured PA among youth.\textsuperscript{27}

Our overall measure of WBPA included 4 (sports, class other than gym or recess, after school during the week, weekends) of the 6 categories listed in the survey. We excluded gym class and recess physical activities because of the unreliability of these measures. Our pretesting suggested that it was difficult for girls to accurately report the amount and intensity in these settings. In addition, research suggests that the amount and level of intensity can vary greatly in gym class and recess.\textsuperscript{28}

We calculated the weekly time spent on each WBPA by multiplying minutes per day by number of days per week of engaging in that activity. Total time for each of the 4 categories was calculated by summing the time spent on all the WBPAs in that category. Average daily WBPA was calculated by summing the time reported per week in the 4 categories and dividing by 7. For the regression analysis, we used a natural logarithmic transformation of the average time spent per day on WBPA as the dependent variable to meet the assumptions of regression.

Indicator Variables: Girls’ Measures

**Attitudes: Perceived Benefits and Barriers.** Using a 4-point agreement scale (1 = strongly disagree, 4 = strongly agree), we used 7 statements to assess perceived benefits and barriers associated with PA. (The statements included *I feel safe doing physical activities outside in my neighborhood; Doing physical activities is lots of fun; Often there is no one around for me to do physical activities with; I am usually too tired after school to be physically active; There are lots places in
my neighborhood where I can be physically active; There are lots of after-school sports and other physical activities for me to pick from that I like; I’d rather watch TV or play on a computer than do physical activities.) Response categories were dichotomized for the analyses into 1 = strongly agree/agree and 0 = disagree/strongly disagree.

Beliefs About How Much Time Should Be Spent in PA. Girls were asked how many days each week and how many minutes a day a girl their age should be physically active. The reported number of days (0–7) was multiplied by the reported number of minutes (0–240) and divided by 7 to calculate the response for minutes per day.

Peer Influence. Using a 4-point scale (0 = none, 1 = some, 3 = most, 4 = all), peer influence was assessed by having girls estimate (1) how many of their friends were physically active every day and (2) how many of their friends would think it was “weird” if they suggested going for a walk or playing a sport instead of hanging out at the mall or watching TV. Each measure was dichotomized in the analyses into 1 = all/most and 0 = some/none.

PA With Parent. Girls were asked to report the number of days in the past week they did a physical activity with either of their parents.

Self-Efficacy. Using a 4-point scale (1 = very easy, 4 = very difficult), girls were asked how easy or difficult it would be for them to be physically active every day. The 4-point scale was dichotomized in the analyses into 1 = very easy/easy and 0 = very difficult/difficult.

Perceived Physical Competence. Using a 4-point scale (1 = very good, 2 = pretty good, 3 = not so good, 4 = not good at all), girls were asked to rate how good they were in activities in physical education or gym class. These response categories were dichotomized in the analyses into 1 = very good/pretty good and 0 = not so good/not good at all.

Indicator Variables: Measures for Parents

Attitudes: Perceived Benefits and Barriers. Using a 10-point agreement scale (1 = strongly disagree, 10 = strongly agree), we used 5 statements to measure perceived benefits of PA and possible barriers to engaging in it. (The statements included Girls who are physically active have more self-confidence; Girls who are physically active do better in school; I don’t mind going out of my way to take my daughter to places where there are physical activities that she likes to do; There are lots of places in our neighborhood where my daughter can be physically active; On a typical day, my daughter does enough physical activities to be healthy.)

Self-Efficacy. (Confirmatory factor analysis and reliability analysis was conducted to determine if the items could be combined in any way to create a global measure of self-efficacy; however, loadings and reliability of items were insufficient.) To assess parents’ self-efficacy in influencing their daughters’ PA, parents were asked to rate how easy or difficult it would be for them to do the following: (1) get their daughter to be physically active every day, (2) find time for their daughter to be more physically active, and (3) do physical activities with their daughter regularly, all using a 10-point scale (1 = very difficult, 10 = very easy). In addition, parents
were asked to rate how much influence they thought they had over their daughter’s amount of daily PA using a different 10-point scale (1 = no influence at all, 10 = extreme influence).

**Parental Encouragement.** To assess their encouragement of PA, parents were asked on how many days of the past 30 they had talked with their daughter about being physically active.

**Parental Modeling.** Two behavioral measures (sedentary behaviors and parental PA) were used to assess parental modeling. Parents were asked the number of hours per day they watched TV and the number of days a week they were physically active.

**Demographics.** Demographic variables included the girl’s age and race/ethnicity, number of parents in the household, and parent’s education. (Parent education was only collected for the parent completing the survey, not for both parents.)

**Statistical Analysis**

The data were weighted to be nationally representative of girls by age, race, region of the country, and household income (see Table 1 for a comparison with the US

**Table 1 Demographics of Girls 9 to 12, Unweighted, Weighted, and Compared With the US Census**

<table>
<thead>
<tr>
<th></th>
<th>Unweighted (N = 1000), %</th>
<th>Weighted* (N = 825), %</th>
<th>US Census, b %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls’ race/ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White, non-Hispanic</td>
<td>75.8</td>
<td>62.0</td>
<td>64.4</td>
</tr>
<tr>
<td>Black/African American, non-Hispanic</td>
<td>8.7</td>
<td>14.7</td>
<td>15.6</td>
</tr>
<tr>
<td>Hispanic</td>
<td>9.2</td>
<td>16.7</td>
<td>15.0</td>
</tr>
<tr>
<td>other</td>
<td>3.4</td>
<td>3.8</td>
<td>5</td>
</tr>
<tr>
<td>not reported</td>
<td>2.9</td>
<td>2.9</td>
<td>—</td>
</tr>
<tr>
<td>Household income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>less than $45,000</td>
<td>21.8</td>
<td>34.3</td>
<td>40.5</td>
</tr>
<tr>
<td>$45,000–$75,000</td>
<td>33.3</td>
<td>23.3</td>
<td>27.9</td>
</tr>
<tr>
<td>more than $75,000</td>
<td>34.3</td>
<td>30.9</td>
<td>31.6</td>
</tr>
<tr>
<td>refused</td>
<td>10.6</td>
<td>11.5</td>
<td>—</td>
</tr>
<tr>
<td>Highest level of education for parent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>high school or less</td>
<td>20.9</td>
<td>23.5</td>
<td>40.9</td>
</tr>
<tr>
<td>some college/associate’s degree</td>
<td>37.6</td>
<td>38.7</td>
<td>29.5</td>
</tr>
<tr>
<td>4-year college/graduate study</td>
<td>41.3</td>
<td>37.5</td>
<td>29.6</td>
</tr>
<tr>
<td>refused</td>
<td>0.2</td>
<td>0.2</td>
<td>—</td>
</tr>
<tr>
<td>Girls’ age (y)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9–10</td>
<td>51.8</td>
<td>54.0</td>
<td>—</td>
</tr>
<tr>
<td>11–12</td>
<td>48.2</td>
<td>46.0</td>
<td>—</td>
</tr>
</tbody>
</table>

* Data are weighted to reflect the US population of girls age 9 to 12 years by race, region of country, and household income.

b US population data for race/ethnicity of girls age 9 to 18 years, income for households with a 9- to 18-year-old girl, and parent education averaged from households with girls 9 to 12 and households with girls 13 to 18.
Census data). All analysis was conducted using SPSS 13.0.1 (SPSS, Inc, Chicago, IL, December 2004). Analysis of variance (ANOVA) was conducted to examine differences in PA and WBPA by girls’ age, race, and parental education. Multiple linear regression analysis was conducted to examine the association between WBPA per day and girls’ attitudes and beliefs, self-efficacy, peer influence, reported PA with parent, parents’ attitudes, parental modeling, parental self-efficacy, and parental encouragement. To control for demographic differences, the girls’ age and race or ethnicity and parents’ education were also included in the regression analysis as potential predictors. All variables were entered simultaneously.

Several steps were taken to reduce the number of predictors and the likelihood of multicollinearity in the regression analysis. Confirmatory factor analysis and reliability analysis were conducted to determine if items could be combined (eg, parent attitude items, girls’ attitude items); however, factor loadings and item reliability (Cronbach alpha ranged from .22–.60) were insufficient. Collinearity statistics indicated that the predictors were well within acceptable levels—the lowest tolerance was .48 and the highest VIF was 2.1. Post hoc t-test analyses were conducted after the regression analysis to examine in more detail the contribution of the individual correlates of girls’ WBPA.

**Results**

The unweighted and weighted distributions of demographic characteristics for the study sample of girls age 9 to 12 years are shown in Table 1. In unweighted results, among the households with girls 9 to 12 that completed the survey, over three-fourths were White, more than 67% had incomes over $45,000, and 41% had a parent with at least a college degree.

**Measures of PA by Demographics**

A summary of total PA and WBPA by age (9–12 years), race/ethnicity, and parental education is shown in Table 2. An ANOVA indicated an overall difference in WBPA by girls’ age, but post hoc analysis indicated no significant differences between age groups. White girls reported participating in more total PA and WBPA than either African Americans or Hispanics. Although there appeared to be a trend for greater PA with higher education levels (of parents), these findings were not significant.

**Regression Analysis**

Multiple regression analysis was conducted to examine the association between WBPA per day and girls’ attitudes and beliefs, self-efficacy, peer influence, reported PA with parent, parents’ attitudes, parental modeling, parental self-efficacy, and parental encouragement. To control for demographic differences, the girls’ age and race or ethnicity and parents’ education were also included in the regression analysis as potential predictors. The results for all correlates are displayed in Table 3. The overall model regressing the log of WBPA on the correlates was significant ($F_{31,685} = 3.72, P < .001$, adjusted $R^2 = .11$). Greater WBPA was significantly associated with parent’s education, parental self-efficacy in getting the daughter to be physically
### Table 2  Measures of Physical Activity by Age, Race or Ethnicity, and Education of Parent

<table>
<thead>
<tr>
<th></th>
<th>Physical activity (min/d)</th>
<th>Total</th>
<th>Weight-bearing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>95% CI</td>
</tr>
<tr>
<td>Total</td>
<td>36.6</td>
<td>32.2</td>
<td>34.4–38.8</td>
</tr>
<tr>
<td>Age (y)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>34.7</td>
<td>27.6</td>
<td>30.8–38.7</td>
</tr>
<tr>
<td>10</td>
<td>35.2</td>
<td>31.2</td>
<td>31.4–39.0</td>
</tr>
<tr>
<td>11</td>
<td>39.0</td>
<td>32.8</td>
<td>34.6–43.4</td>
</tr>
<tr>
<td>12</td>
<td>37.8</td>
<td>37.3</td>
<td>32.1–43.6</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>40.0&lt;sup&gt;c&lt;/sup&gt;</td>
<td>32.3</td>
<td>37.2–42.8</td>
</tr>
<tr>
<td>African American</td>
<td>29.4&lt;sup&gt;d&lt;/sup&gt;</td>
<td>32.9</td>
<td>23.5–35.3</td>
</tr>
<tr>
<td>Hispanic</td>
<td>31.3&lt;sup&gt;d&lt;/sup&gt;</td>
<td>29.7</td>
<td>26.3–36.3</td>
</tr>
<tr>
<td>Parental education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>high school or less</td>
<td>33.4</td>
<td>30.7</td>
<td>29.1–37.8</td>
</tr>
<tr>
<td>some college/associate’s</td>
<td>37.7</td>
<td>33.3</td>
<td>34.0–41.3</td>
</tr>
<tr>
<td>college or more</td>
<td>37.6</td>
<td>31.9</td>
<td>34.1–41.2</td>
</tr>
</tbody>
</table>

<sup>a</sup>This is based on the actual time spent on physical activity per day and not the natural logarithmic transformation of this measure.

<sup>b</sup>ANOVA indicated an overall significant \((P < .05)\) difference for weight-bearing physical activity by age, but post hoc \(t\) tests did not show any significant differences between specific age groups.

<sup>c</sup> > 4, \(P < .001\).

<sup>d</sup> > 1, \(P < .01\).

active every day, girl’s perception of min/d a girl her age should be active, number of past 7 days a girl was physically active with a parent, girl’s perceptions of her friends’ activity (number of friends who are physically active every day), and the perceived availability of after-school and other physical activities from which to choose.

### Post Hoc Analysis: PA With Parent in the Past 7 Days

Because parents’ PA with their daughter explained the most variance, and because this is an area potentially open to intervention, we created 2 parent–daughter PA groups with comparable sample sizes and conducted \(t\) tests with the measures for parents to compare the 2 groups. The first group consisted of girls who reported participating in PA with a parent for 2 or more of the past 7 days \((n = 394, 48.6\%)\), and the second group included girls who participated in PA with a parent on 0 to 1 day in the past 7 days \((n = 418, 51.4\%)\).

Findings indicated that girls who reported participating in 2 or more days of PA with a parent were more likely to have parents that reported greater perceived benefits and fewer barriers concerning their daughters’ PA, greater self-efficacy, and more encouragement of girls’ PA (see Table 4).
Table 3  Correlates of WBPA Among Girls 9 to 12 Years

<table>
<thead>
<tr>
<th>Variable</th>
<th>Beta</th>
<th>SE</th>
<th>Correlation with WBPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>education of parent</td>
<td>.10^b</td>
<td>.037</td>
<td>.07</td>
</tr>
<tr>
<td>age group</td>
<td>.07</td>
<td>.036</td>
<td>.05</td>
</tr>
<tr>
<td>Black (vs. White)</td>
<td>−.05</td>
<td>.043</td>
<td>−.10^a</td>
</tr>
<tr>
<td>Hispanic (vs. White)</td>
<td>.03</td>
<td>.038</td>
<td>−.01</td>
</tr>
<tr>
<td>Other (vs. White)</td>
<td>.03</td>
<td>.037</td>
<td>−.01</td>
</tr>
<tr>
<td>2-parent household (yes)</td>
<td>−.03</td>
<td>.039</td>
<td>−.01</td>
</tr>
<tr>
<td>Parent modeling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no. of h/d personally watching TV</td>
<td>−.03</td>
<td>.04</td>
<td>.10^a</td>
</tr>
<tr>
<td>no. of days a week physically active</td>
<td>.03</td>
<td>.039</td>
<td>.07^c</td>
</tr>
<tr>
<td>Parental attitudes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There are lots of places in the neighborhood where my daughter can be physically active.</td>
<td>.01</td>
<td>.041</td>
<td>.12^b</td>
</tr>
<tr>
<td>On a typical day, my daughter does enough PA to be healthy.</td>
<td>.05</td>
<td>.051</td>
<td>.18^b</td>
</tr>
<tr>
<td>Girls who are physically active have more self-confidence.</td>
<td>.04</td>
<td>.048</td>
<td>.15^b</td>
</tr>
<tr>
<td>Girls who are physically active do better in school.</td>
<td>.05</td>
<td>.048</td>
<td>.13^b</td>
</tr>
<tr>
<td>I don’t mind going out of my way to take my daughter to places for PA</td>
<td>.04</td>
<td>.04</td>
<td>.13^b</td>
</tr>
<tr>
<td>Parental self-efficacy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It is easy to find time for my daughter to be more physically active.</td>
<td>−.08</td>
<td>.042</td>
<td>.03</td>
</tr>
<tr>
<td>It is easy to get my daughter to be physically active every day.</td>
<td>.11^c</td>
<td>.048</td>
<td>.15^b</td>
</tr>
<tr>
<td>It is easy to do PA with my daughter regularly.</td>
<td>−.02</td>
<td>.04</td>
<td>.03</td>
</tr>
<tr>
<td>I have an extreme influence over my daughter’s daily PA.</td>
<td>−.03</td>
<td>.039</td>
<td>.02</td>
</tr>
<tr>
<td>Parental influence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no. of last 30 days talked with daughter about PA</td>
<td>.06</td>
<td>.038</td>
<td>.07</td>
</tr>
<tr>
<td>girl’s beliefs in number of min a day a girl should be physically active.</td>
<td>.12^d</td>
<td>.036</td>
<td>.12^b</td>
</tr>
<tr>
<td>girl’s reported PA with parent: no. of past 7 days did PA with either parent</td>
<td>.13^d</td>
<td>.039</td>
<td>.14^b</td>
</tr>
<tr>
<td>Peer influence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How many friends are physically active every day?</td>
<td>.09^d</td>
<td>.037</td>
<td>.15^b</td>
</tr>
<tr>
<td>Friends think it’s weird if I choose walk/sport instead of TV/mall.</td>
<td>.00</td>
<td>.036</td>
<td>−.00</td>
</tr>
<tr>
<td>Girl’s attitudes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel safe to do PA outside in my neighborhood.</td>
<td>.00</td>
<td>.037</td>
<td>.06</td>
</tr>
<tr>
<td>Doing physical activities is lots of fun.</td>
<td>.02</td>
<td>.037</td>
<td>.05</td>
</tr>
<tr>
<td>Often there is no one to do PA with.</td>
<td>.00</td>
<td>.038</td>
<td>−.07</td>
</tr>
<tr>
<td>I am usually too tired after school to do PA.</td>
<td>−.05</td>
<td>.038</td>
<td>−.09^a</td>
</tr>
<tr>
<td>There are lots of places in my neighborhood to be physically active.</td>
<td>.06</td>
<td>.039</td>
<td>.12^a</td>
</tr>
<tr>
<td>There are lots of after-school sports/PA for me to pick from.</td>
<td>.09^a</td>
<td>.037</td>
<td>.13^b</td>
</tr>
<tr>
<td>I would rather watch TV/hang out at mall than do PA.</td>
<td>−.03</td>
<td>.039</td>
<td>−.12^b</td>
</tr>
<tr>
<td>Girl’s self-efficacy: easy to be physically active every day</td>
<td>.00</td>
<td>.038</td>
<td>.09^c</td>
</tr>
<tr>
<td>Girl’s perceived competence: how good at activities in PE/gym</td>
<td>.02</td>
<td>.037</td>
<td>.07</td>
</tr>
</tbody>
</table>

Abbreviations: WBPA, weight-bearing physical activity; PA, physical activity; PE, physical education.

^a Girls’ age, race or ethnicity, and parents’ education were included in the regression analysis as potential predictors to control for demographic differences.

^b P < .05; ^c P < .01; ^d P < .001.
Table 4  Parental Measures by Girls’ Reported Physical Activity With Parent

<table>
<thead>
<tr>
<th>Days with PA with parent</th>
<th>≥2 days</th>
<th>0–1 days</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental modeling (mean ± SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>number of hours a day spent watching TV</td>
<td>1.9 ± 1.4</td>
<td>1.9 ± 1.5</td>
<td>.94</td>
</tr>
<tr>
<td>number of days physically active</td>
<td>4.7 ± 2.1</td>
<td>4.1 ± 2.2</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Parental attitudes (mean ± SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There are lots of places in the neighborhood to be physically active.</td>
<td>6.6 ± 3.1</td>
<td>6.1 ± 3.0</td>
<td>.03</td>
</tr>
<tr>
<td>My daughter does enough PA to be healthy.</td>
<td>7.5 ± 2.4</td>
<td>6.9 ± 2.6</td>
<td>.001</td>
</tr>
<tr>
<td>Girls who are physically active have more self-confidence.</td>
<td>8.9 ± 1.6</td>
<td>8.5 ± 1.8</td>
<td>.001</td>
</tr>
<tr>
<td>Girls who are physically active do better in school.</td>
<td>8.0 ± 2.3</td>
<td>7.7 ± 2.2</td>
<td>.05</td>
</tr>
<tr>
<td>I don’t mind going out of my way for PA.</td>
<td>9.0 ± 1.6</td>
<td>8.8 ± 1.6</td>
<td>.04</td>
</tr>
<tr>
<td>Parental self-efficacy (mean ± SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It is easy to find time for my daughter to be more physically active.</td>
<td>7.2 ± 2.4</td>
<td>6.4 ± 2.5</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>It is easy to get my daughter to be physically active every day.</td>
<td>7.6 ± 2.7</td>
<td>7.0 ± 2.6</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>It is easy to do PA with my daughter regularly.</td>
<td>6.6 ± 2.6</td>
<td>5.8 ± 2.3</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Influence over daughter’s PA</td>
<td>7.2 ± 2.1</td>
<td>6.7 ± 1.9</td>
<td>.001</td>
</tr>
<tr>
<td>Parental encouragement (mean ± SD): last 30 days talked to daughter about PA</td>
<td>7.3 ± 8.7</td>
<td>5.7 ± 7.0</td>
<td>&lt;.01</td>
</tr>
</tbody>
</table>

Abbreviation: PA, physical activity.

a  T tests were used to conduct all post hoc analysis.

Discussion

The goal of the current study was to explore psychosocial, environmental, and demographic correlates of girls’ WBPA by analyzing results from surveys conducted with adolescent girls and their parents. Overall, our findings suggest that social support, as expressed by having parents who are active with their daughter and having more friends who are physically active, is very important for girls’ WBPA. Biddle and colleagues recently reported that parents play an important role in girls’ PA overall,9 and our findings are consistent with theirs. They are also consistent with other studies that found various forms of parental support, such as participating in activities with their children,14 organizing activities for them,29 providing them with transportation,30 or purchasing PA equipment,31 to be the most effective strategies to encourage PA among children. Findings from the post hoc analysis indicated that parents with greater participation in PA with their daughter were more likely to be active themselves, to have positive attitudes about PA for their daughter, to feel there were many places in the neighborhood for PA, and to have high self-efficacy in their ability to influence their daughter’s PA. Parental self-efficacy also had a main effect on girls’ WBPA. Because causal direction is not known for these relationships, we can only suggest that increasing parents’ positive attitudes and self-efficacy be tested as a means to increase girls’ WBPA.

We did not find parental modeling alone to be a significant indicator of girls’ WBPA; previous research has been mixed regarding the influence of such modeling
on children’s PA. Some studies have found positive relationships between physical activities and the sedentary behaviors of parents and children, whereas others have suggested that parents as role models have limited influence on children’s PA. Similarly, we did not find self-reported parental encouragement by itself to be a significant indicator of WBPA, unlike findings for PA in other studies. These findings might be explained by the fact that our sample was limited to girls. Other studies suggest that the relationship between parental encouragement and PA is stronger for boys than girls.

Consistent with other studies, we found some support for peer influence (physically active friends). Perhaps the finding here simply reflects that active girls choose to associate with active friends. In fact, a recent review found that peer influence was inconsistently associated with PA among adolescent girls but did have a very strong effect for participation of this group in organized sports. Our finding, combined with this one, suggests it might be effective for parents to encourage their daughters to enroll in sports and other activities in which they will have greater opportunity to develop friendships with active peers.

Our finding in the regression analysis that parental education was positively associated with WBPA fits well with some previous research. In contrast, race/ethnicity was not an independent predictor of WPBA in the regression model. As has been suggested previously, racial and ethnic differences in PA might be largely the result of socioeconomic factors, which would fit with parents’ education being positively associated with girls’ WPBA but not race/ethnicity.

A recent study found perceived competence, self-efficacy, and enjoyment to be positively correlated and perceived barriers to be negatively correlated with PA among adolescent girls. In contrast, we found that, in most cases, the girls’ attitudes about perceived benefits and barriers relative to PA were not independent predictors of their WBPA level. We should note, however, that some of the many benefits examined in the previous study were not included in ours. We did find that the perceived availability of after-school sports and other physical activities was significantly associated with WBPA, a finding consistent with other studies that have found that the availability of sports activities after school and access to community PA programs encourage girls’ PA.

In contrast to other studies, we did not find that girls’ self-efficacy independently predicted WBPA. Younger children are particularly dependent and influenced by their parents, and thus parental self-efficacy might be more critical than the daughters’ self-efficacy when it comes to WBPA.

In our regression analysis, perceptions of the time a girl should be physically active were positively associated with WBPA, but what to conclude from this finding is not clear. Perhaps girls who engage in more PA (either overall or weight bearing) also tend to believe that others should spend more time being physically active. Few studies have generally examined the relationship between knowledge about recommended levels of PA and behavioral indices, and recommended levels of WBPA have not been determined. As a result, we cannot categorize the girls’ responses as measuring their knowledge of a recommended level.
Limitations

The current study has several limitations. First, because the data are self-reported, inherent threats to validity and reliability, particularly for younger children, must be taken into account. There is some evidence to suggest that the girls in our study might have overestimated their PA, because national data on 9- to 13-year-olds indicate that 62% of such children do not participate in any organized PA during nonschool hours. In contrast, in our sample, 50% of girls age 9 to 13 years reported participating in 30 minutes or more of PA every day during nonschool hours. As girls generally participate in less PA than boys, we would expect girls in our sample to report less PA than the national average. Another possible limitation involves generalizability of the findings. Although the data were weighted according to the US Census population, the sample was still more educated and of higher economic status than the general public, and thus it will be important to do further studies with girls of lower SES. A third concern is that our study had limited measures of each construct, and these measures were not standardized and validated across multiple studies. Finally, we should note that this is a cross-sectional study and, as such, causality cannot be inferred. We recommend further research to examine the causal direction of the associations between social and attitudinal factors and WBPA, preferably with multiple measures of the indicator variables in a longitudinal study.

Application

In addition to needing PA in general, growing girls need WBPA to help build and maintain healthy bones and prevent osteoporosis later in life. Similar to other studies examining predictors of children’s overall PA, our study suggests that parents can play an important role in encouraging WBPA for their daughter. Our findings suggest that increasing social support, particularly from parents, might be one avenue for increasing WBPA among girls age 9 to 12. To provide additional information for bone-health interventions with girls, researchers need to develop and test interventions that encourage parents to participate in WBPA with their daughters and increase parents’ positive attitudes and self-efficacy in their ability to influence their daughters to be physically active.

Our findings further suggest that providing physical and social environments that enable PA is important for increasing WBPA among girls. Accordingly, future research should test interventions involving the number and type of after-school sport and PA programs offered by schools and community centers to examine the effect of offerings on girls’ WBPA.

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References


