

# Physical Activity Correlates in Adolescent Girls Who Differ by Weight Status

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## Abstract

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**Objective:** This study compared correlates of physical activity (PA) among African-American and white girls of different weight groups to guide future interventions.

**Research Methods and Procedures:** Participants were 1015 girls (mean age, 14.6 years; 45% African-American) from 12 high schools in South Carolina who served as control subjects for a school-based intervention. Post-intervention measures obtained at the end of ninth grade were used. PA was measured using the Three-Day PA Recall, and a questionnaire measured social-cognitive and environmental variables thought to mediate PA. Height and weight were measured, and BMI was calculated. Girls were stratified by race and categorized into three groups, based on BMI percentiles for girls from CDC growth charts: normal (BMI < 85th percentile), at risk (BMI, 85th to 94th percentile), and overweight (BMI ≥ 95th percentile). Girls were further divided into active and low-active groups, based on a vigorous PA standard (average of one or more 30-minute blocks per day per 3-day period). Mixed-model ANOVA was used to compare factors among groups, treating school as a random effect

**Results:** None of the social-cognitive or environmental vari-

ables differed by weight status for African-American or white girls. Perceived behavioral control and sports team participation were significantly higher in girls who were more active, regardless of weight or race group. In general, social-cognitive variables seem to be more related to activity in white girls, whereas environmental factors seem more related to activity in African-American girls.

**Discussion:** PA interventions should be tailored to the unique needs of girls based on PA levels and race, rather than on weight status alone.

**Key words:** overweight, exercise, African American, mediators, behavior

## Introduction

Excessive weight gain has become one of the most serious health problems facing American youths today. Obesity rates (BMI ≥ 95th percentile) among adolescents have tripled over the past 25 years, and this trend shows no signs of leveling off (1–3). Data from the 1999 to 2002 National Health and Nutrition Examination Survey (NHANES)<sup>1</sup> indicate that 16.1% of U.S. adolescents 12 to 19 years of age are overweight, an absolute increase of 5% since the 1988 to 1994 survey (4). The rise in the prevalence of overweight was particularly dramatic among non-Hispanic black and Mexican-American adolescents, increasing by more than 10% between 1988–1994 and 2000. Of particular concern is the 23.6% prevalence rate of overweight among non-Hispanic black girls 12 through 19 years old, among the highest of the sex and racial/ethnic groups (4).

Physical inactivity and sedentary lifestyles contribute to obesity and may be fundamental sources of energy imbalance (5). Girls, at all ages, are less active than boys, and this difference is particularly large during the adolescent years (6–8). African-American girls seem to be at greater risk for

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<sup>1</sup> Nonstandard abbreviations: NHANES, National Health and Nutrition Examination Survey; PA, physical activity; 3DPAR, Three-Day PA Recall; MET, metabolic equivalent; PE, physical education.

physical inactivity than other population groups (8,9). Alarming findings were reported recently by the National Heart, Lung, and Blood Institute Growth and Health Study, a 10-year longitudinal study documenting changes in physical activity (PA) behavior in a cohort of 1213 African-American and 1166 white girls (10). Between ages 9-10 and 16-17 years, median habitual leisure-time PA declined by 100% in African-American girls, compared with 64% for white girls. Fifty-six percent of the African-American girls reported no leisure-time PA at the end of the study period (10).

In the face of such trends, interventions must be designed that will prevent, or at least reduce, the sharp decline in PA in adolescent girls at risk for overweight (11). If such interventions are to be effective, however, a critical part of their design must be a better understanding of the factors that influence PA behavior and whether these factors vary by weight status (12–15). In a series of reports on cohorts of ninth grade girls enrolled in the Lifestyle Education for PA Program, we have reported that self-efficacy, perceived behavioral control, enjoyment, social support, and access to PA equipment were independently related to PA (16–24). Although the direction and magnitude of those relations were similar between African-American and white girls, the groups differed absolutely in their levels of PA and its correlates. White girls reported more moderate-to-vigorous PA (25) and had higher scores on measures of attitude, self-efficacy, perceived behavioral control, subjective norms, and perceived environment for PA (19,20,24,26) than African-American girls. Although African-American girls had higher BMI than white girls, in the previous reports we did not examine whether the relationship with PA observed for the aforementioned variables were confounded with or modified by weight status. Similarly, other investigators who reported that access to exercise facilities and programs mediated the effect of race on PA among adolescents did not examine whether body weight had independent or interactive effects on PA (27).

A recent study of adults suggests that such relationships might, indeed, differ according to weight status. Blanchard et al. (28) found that weight status (normal, overweight, and obese) modified the strength of association among self-efficacy, social support, and access to neighborhood facilities and PA. Using data from a group of 12- to 18-year-olds, Taylor et al. (29) found that factors such as family support, peer support, and activity choices were significantly related to PA in normal-weight youths but found no association among the correlates and PA for the overweight group. Other studies have investigated PA correlates of overweight youth, but none considered the interaction of weight and activity status (30–33).

Hence, the purpose of the analyses in this report was to compare selected social-cognitive and environmental correlates of PA in white and African-American adolescent girls

classified by weight status and activity level. BMI was uncorrelated with moderate ( $r = 0.02$ ) and vigorous ( $r = 0.05$ ) PA in the studied sample. Hence, stratification of the sample by PA and weight status permitted tests of their independent and interactive effects. We hypothesized that white and African-American overweight adolescent girls would have personal attributes, sociodemographic characteristics, or family structures that differ significantly from their non-overweight counterparts. However, we also felt that girls' PA levels might alter these relations, and, together, such information could be used to design more targeted interventions for overweight adolescent girls (34,35).

## Research Methods and Procedures

### Subjects

Subjects for this study were 1162 girls from 12 high schools in South Carolina who served as controls for a school-based PA intervention and were measured post-intervention in the ninth grade. Although individual subject-level data on household income were not available, the schools in this study represent a typical range of public high schools in South Carolina. Median percentage of subjects qualifying for free or reduced lunch in these schools was 39%, and the percentage enrollment of African-American students was 41%. Girls with missing values for age ( $n = 23$ ), race ( $n = 3$ ), BMI ( $n = 47$ ), or PA ( $n = 29$ ) were deleted from the pool of subjects. Also deleted were 45 girls with race designations other than African-American or white, leaving data from a total of 1015 girls for analysis. On average, the girls were 14.6 years of age, and 45% were African American (Table 1). Before participation in the study, written informed consent was obtained from each student and her primary guardian. The study was approved by the University of South Carolina Institutional Review Board.

### Measures

*Anthropometric Measures.* Height and weight measures were conducted at the school sites in a private setting, with girls dressed in light clothing. Weight was assessed using high precision electronic scales (BeFour, Inc., Saukville WI) and measured to the nearest 0.2 kg. Height was measured to the nearest 1.0 cm using a portable stadiometer (Shorr Productions, Olney, MD). BMI was calculated by dividing weight in kilograms by height in meters squared. All measures were collected in the school setting by trained data collectors. These individuals completed several days of training before data collection and were certified as competent by the study's measurement coordinator. Both white and African-American staff members were employed. Equipment was checked regularly for precision.

*PA.* PA was measured using a self-report instrument, the Three-Day PA Recall (3DPAR), a modification of the Pre-

**Table 1.** Characteristics of 1015 ninth grade girls

Characteristic (mean $\pm$ SD or %)	No.
Age (years; 14.6 $\pm$ 0.6)	1015
African American (44.6%)	453
Weight Status	
Normal (63.7%)	646
White (69.2%)	
African American (56.7%)	
At risk (15.8%)	160
White (14.8%)	
African American (17.0%)	
Overweight (20.6%)	209
White (16.0%)	
African American (26.3%)	
Active (41.2%)	418
White (45.7%)	
African American (35.5%)	

SD, standard deviation.

vious Day PA Recall (36). The 3DPAR has been found to be a valid instrument for assessing PA in adolescent girls (37). The 3DPAR is organized into 34 30-minute blocks of time from 7 AM until midnight. Fifty-five common activities are listed on the form. Respondents enter the main activity performed and the intensity at which the activity was performed during each of the 30-minute periods over the previous 3 days (2 weekdays and 1 weekend day). Based on the PA and intensity reported, each activity is assigned a literature-based metabolic equivalent (MET) value (38). Data are reduced to the number of 30-minute blocks per day in which the main activity is rated as moderate (3 to 5.9 METs) or vigorous (6 or more METs) intensity. Television viewing time was estimated by the number of 30-minute blocks of time in which television watching or playing videos was identified as the primary activity on the 3DPAR.

*PA Correlates.* All girls completed a questionnaire that measured a number of social-cognitive and environmental correlates that have been shown to be associated with PA in youth (39). The variables were selected from among those associated with the Social Cognitive Theory (40) and the Theory of Reasoned Action/Planned Behavior (41). Questionnaires were administered in a classroom setting by trained research assistants using a standardized script. During the administration of the questionnaires, an assistant moved around the classroom to answer any questions and to check for problems.

Social-cognitive variables included PA self-efficacy, attitudes, perceived behavioral control, subjective norms, en-

joyment of PA, and factors influencing the enjoyment of physical education (PE). The measures for these variables were modified from previously published instruments (42) or specifically developed and validated for the present study (16,17,24). Before data collection, each measure was pilot tested to ensure that the reading level and response format were appropriate for ninth grade students. The complete psychometric properties of these measures have been reported elsewhere (43).

The self-efficacy measure consisted of eight items rated on five-point Likert-type scales anchored by 1 (disagree a lot) and 5 (agree a lot). The attitudes scale measured beliefs about consequences of being physically active and evaluations of each of those consequences. Beliefs were measured on a five-point Likert-type scale from disagree a lot to agree a lot. The evaluation (values) component was measured on a five-point Likert-like scale, using a range from very good to very bad. Attitudes scores were computed by multiplying each belief statement by its corresponding value and averaging those products. The measure of perceived behavioral control included four items, rated on a five-point Likert-type scale anchored by 1 (very easy) and 5 (very difficult). The subjective norms measure included eight items that consisted of normative beliefs and corresponding statements about their motivation to comply. Normative belief statements were rated on a five-point Likert-type scale anchored by 1 (disagree a lot) and 5 (agree a lot). Statements about motivation to comply were rated on a five-point Likert-type scale, with responses ranging from 1 (disagree a lot) to 5 (agree a lot). Subjective norms scores were computed by averaging the product of each normative belief multiplied by its motivation to comply score. Enjoyment of PE was measured using a 14-item Likert-type scale, and enjoyment of PA was measured by a 12-item Likert-type scale, with responses ranging from 1 (very unenjoyable) to 5 (very enjoyable) (17).

The girls completed environmental questions on family support, social provisions for activity, availability of home equipment, presence of parks/gyms, safety of activity spaces, TV watching, and participation in sports teams (school sports and community sports). The family support scale contained five four-point scale items that assessed frequency of support from family members, anchored by 0 (none) and 4 (daily), and included don't know. These scales were designed to measure family members' (adult men, adult women, and siblings) involvement with the participant in various physical activities during a typical week. For example, the respondents were asked, "During a typical week, how often has \_\_\_\_\_ encouraged you to do PA or sports?" The respondent provided three separate scores, one for the adult male family member, one for the adult female family member, and one for the siblings in the family. A total score for family support was derived by averaging the ratings of the three family members. Test-

retest reliability for the family support scale is 0.86. The social provisions scale consisted of 12 items from three subscales (guidance, nurturance, and reassurance of worth) that exhibited evidence of factorial and construct validity for African-American and white girls (19). The 12 items were rated on a five-point scale ranging from disagree a lot (1) to agree a lot (5) and were summed to form a single scale score for social provisions (19,20). This scale has stability coefficients of 0.60 to 0.64 (19,20). Physical environment measures include availability of home equipment, parks/gyms, and safe activity spaces. These environmental variables included five separate five-point Likert scale items with response options ranging from 1 (disagree a lot) to 5 (agree a lot). Participation on sports teams (school and community) was measured by two questions adapted from the Youth Risk Behavior Surveillance system (9) having yes or no responses. Test-retest reliability of sports equipment, parks/gyms, safe activity spaces, and sports teams scales ranged from 0.89 and 0.95 (43). Responses to the 3DPAR were used to measure television/video watching in 30-minute block segments.

### **Procedures**

Girls were grouped into three weight groups, based on sex- and age-specific BMI percentiles for girls from the Centers for Disease Control and Prevention growth charts (44). Girls with a BMI less than the 85th percentile were considered to be normal weight, those with BMI levels between the 85th and the 94th percentiles were considered at risk for overweight, and girls at the 95th percentile or higher were considered to be overweight. Girls were considered to be in the active group if they met a vigorous PA standard of having an average of one or more 30-minute blocks of vigorous (6 METs or greater) PA per day averaged over the 3 days of measurement. This definition was based on the guidelines of the International Consensus Conference on Adolescent Physical Activity and Healthy People 2010 22-7, which include a vigorous PA standard (45,46). Participation in vigorous PA is used in the Youth Risk Behavior Surveillance System, the primary monitoring and surveillance system for PA in U.S. youth (9).

### **Statistical Analysis**

Results were analyzed using two-way mixed model ANOVA, with two between-group factors, weight status (normal weight, at risk for overweight, and overweight) and activity group (active and low active). Because the girls were students from 12 different high schools, and girls from a given school share an environment and many social experiences, it was important to control for the influence of school in the analyses. In all ANOVAs, school was incorporated as a random effect. Data were stratified by race for all analyses. Statistical significance was set at an  $\alpha$  level of 0.05.

## **Results**

Twenty-one percent of girls in the overall sample were classified as overweight, compared with the national prevalence level of 16% reported in NHANES (4). In our sample, more African-American girls than white girls were classified as overweight (26.3% vs. 16.0%, respectively). These numbers exceeded those observed in the most recent NHANES report (23.6% African American vs. 12.7% white) (4). Using the classification scheme of active (average of one or more 30-minute blocks of vigorous activity per day over the 3 days monitored), 41.2% of the total sample of girls were rated as active. When divided into weight groups, however, more girls in the normal-weight group were classified as active (44%) than were girls in either the at-risk for overweight (34.4%) or overweight groups (37.8%) ( $\chi^2 p = 0.05$ ). More of the white girls met the vigorous PA standard than did the African-American girls (45.7% vs. 35.5%).

### **Social-Cognitive Variables**

No effects of weight status or interaction between weight status and activity status were found for white girls on any of the social-cognitive variables. White girls in the active group, however, had higher scores on the self-efficacy, attitudes, perceived behavioral control, enjoyment of PA, and enjoyment of PE scales than girls in the low-active group (see Table 2).

Similarly, among African-American girls (Table 2), none of the social-cognitive correlates differed by weight status. When activity status was considered, the only difference observed between the two activity groups was for perceived behavioral control, with active girls scoring higher than low-active girls ( $p = 0.01$ ). A significant interaction between weight status and activity status was observed for self-efficacy, with active girls in the normal-weight and overweight groups having significantly higher scores than girls classified as low active ( $p = 0.02$ ).

### **Environmental Variables**

Neither weight status nor weight-by-activity interaction had a significant effect on any of the environmental variables among the white girls. Activity status, however, was significantly associated with family support and participation in sports teams, with active girls reporting higher scores than low-active girls (see Table 3).

Among African-American girls (Table 3), activity status did have a significant effect on social provisions for PA, home equipment, access to parks and gyms, and participation on sports teams, with active girls exhibiting significantly higher ratings than low-active girls. In addition, active normal-weight girls reported higher levels of family support than those classified as low active. Family support was not associated with activity status among girls classified as at risk or overweight.

**Table 2.** Mixed-model ANOVA results comparing social-cognitive correlates for white ( $n = 562$ ) and African-American ( $n = 453$ ) girls by weight and activity group, mean  $\pm$  SE

Component	Normal weight		At risk		Overweight		Weight	Active	Weight $\times$ activity
	Low	Active	Low	Active	Low	Active			
Self-efficacy									
White	3.7 $\pm$ 0.1	4.0 $\pm$ 0.1	3.8 $\pm$ 0.1	4.2 $\pm$ 0.1	3.8 $\pm$ 0.1	4.0 $\pm$ 0.1	0.11	<0.001*	0.38
African American	3.4 $\pm$ 0.1	3.8 $\pm$ 0.1	3.6 $\pm$ 0.1	3.4 $\pm$ 0.2	3.4 $\pm$ 0.1	3.8 $\pm$ 0.1	0.87	0.03	0.02 <sup>†</sup>
Attitudes									
White	17.7 $\pm$ 0.3	18.7 $\pm$ 0.3	17.7 $\pm$ 0.4	18.9 $\pm$ 0.6	17.8 $\pm$ 0.4	19.0 $\pm$ 0.5	0.90	0.001*	0.91
African American	16.8 $\pm$ 0.3	17.0 $\pm$ 0.4	17.4 $\pm$ 0.4	17.0 $\pm$ 0.7	16.0 $\pm$ 0.4	17.8 $\pm$ 0.5	0.31	0.15	0.44
PBC									
White	4.0 $\pm$ 0.1	4.2 $\pm$ 0.1	4.0 $\pm$ 0.1	4.4 $\pm$ 0.1	4.0 $\pm$ 0.1	4.2 $\pm$ 0.1	0.30	0.001*	0.55
African American	10.4 $\pm$ 0.4	11.1 $\pm$ 0.5	10.9 $\pm$ 0.6	9.8 $\pm$ 1.0	10.7 $\pm$ 0.6	10.8 $\pm$ 0.7	0.39	0.01*	0.83
Subjective norms									
White	11.6 $\pm$ 0.3	12.0 $\pm$ 0.3	10.8 $\pm$ 0.6	12.6 $\pm$ 0.8	13.1 $\pm$ 0.6	12.6 $\pm$ 0.8	0.14	0.25	0.24
African American	10.4 $\pm$ 0.4	11.1 $\pm$ 0.5	10.9 $\pm$ 0.6	9.8 $\pm$ 1.0	10.7 $\pm$ 0.6	10.8 $\pm$ 0.7	0.84	0.84	0.36
Enjoy PA									
White	4.1 $\pm$ 0.1	4.3 $\pm$ 0.1	4.2 $\pm$ 0.1	4.5 $\pm$ 0.1	4.1 $\pm$ 0.1	4.3 $\pm$ 0.1	0.14	0.001*	0.92
African American	4.0 $\pm$ 0.1	4.2 $\pm$ 0.1	4.2 $\pm$ 0.1	4.1 $\pm$ 0.2	4.1 $\pm$ 0.1	4.4 $\pm$ 0.1	0.63	0.20	0.13
Enjoy PE									
White	3.5 $\pm$ 0.1	3.6 $\pm$ 0.1	3.7 $\pm$ 0.1	3.8 $\pm$ 0.1	3.5 $\pm$ 0.1	3.8 $\pm$ 0.1	0.07	0.03*	0.52
African American	3.7 $\pm$ 0.1	3.9 $\pm$ 0.1	3.9 $\pm$ 0.1	3.8 $\pm$ 0.1	3.6 $\pm$ 0.1	3.9 $\pm$ 0.1	0.45	0.08	0.08

SE, standard error; PBC, perceived behavioral control; PA, physical activity; PE, physical education.

\* Active > not active.

<sup>†</sup> Active > not active for normal weight and overweight but not for at-risk group ( $p < 0.05$ ).

## Discussion

Overweight adolescent girls face a variety of psychological and emotional challenges caused by excess body weight (47,48). Some experts have advocated for separate intervention programs for these girls that focus on their unique needs in the development of physically active lifestyles (35). To most effectively design such programs, it is important to understand exactly what factors are associated with PA for girls based on their weight status. In this study, we compared responses of white and African-American girls to an extensive questionnaire measuring a number of social-cognitive and environmental correlates of PA. We were, however, unable to detect any weight-related differences in these behavioral constructs. Only when activity status was included in the analysis were differences detected between the groups of girls. Among those correlates measured, psychosocial factors appeared to be more closely associated with PA level in the white girls, whereas environmental influences seemed to be more closely associated with PA status in the African-American girls.

Of the social-cognitive factors, one was associated with girls' activity both for white and African-American girls: perceived behavioral control. A second factor, self-efficacy, was associated with activity status for all of the white girls and for the normal-weight and overweight African-American girls. In prior analyses using multivariate approaches, we showed that self-efficacy accounted for most of these relationships with PA similarly between African-American and white girls (e.g., 22,26). Among the environmental factors, sports team participation was associated with PA status for both race groups, and family support was associated with PA for both race groups, but only for the normal-weight African-American girls. These findings are consistent with other studies that have identified important correlates of youth PA, although differences based on race rarely have been considered (29,39,49).

Of the previous studies that have focused on weight-related issues, some, but not all, have found certain factors to be different between overweight and non-overweight youth. Zabinski et al. (33) compared questionnaire responses from a group of overweight children (ages 10

**Table 3.** Mixed-model ANOVA results comparing environmental correlates for white ( $n = 562$ ) and African-American ( $n = 543$ ) girls by weight and activity group, mean  $\pm$  SE

Component	Normal weight		At risk		Overweight		Weight	Active	Weight $\times$ activity
	Low	Active	Low	Active	Low	Active			
Family support									
White	1.5 $\pm$ 0.1	1.7 $\pm$ 0.1	1.6 $\pm$ 0.1	1.9 $\pm$ 0.2	1.5 $\pm$ 0.1	1.8 $\pm$ 0.2	0.70	0.01*	0.75
African American	1.5 $\pm$ 0.1	1.9 $\pm$ 0.1	1.6 $\pm$ 0.1	1.6 $\pm$ 0.2	1.7 $\pm$ 0.1	1.8 $\pm$ 0.2	0.74	0.14	0.03 <sup>†</sup>
Social provisions									
White	3.9 $\pm$ 0.1	4.1 $\pm$ 0.1	4.1 $\pm$ 0.2	3.9 $\pm$ 0.2	3.8 $\pm$ 0.2	4.1 $\pm$ 0.3	0.99	0.36	0.37
African American	3.6 $\pm$ 0.1	4.0 $\pm$ 0.1	3.5 $\pm$ 0.2	4.3 $\pm$ 0.4	3.5 $\pm$ 0.2	3.6 $\pm$ 0.2	0.40	0.03*	0.36
Home equipment									
White	4.2 $\pm$ 0.1	4.3 $\pm$ 0.1	4.3 $\pm$ 0.2	4.6 $\pm$ 0.2	4.0 $\pm$ 0.2	4.1 $\pm$ 0.2	0.06	0.18	0.50
African American	3.8 $\pm$ 0.1	4.2 $\pm$ 0.1	3.7 $\pm$ 0.2	3.9 $\pm$ 0.3	3.7 $\pm$ 0.2	4.2 $\pm$ 0.2	0.49	0.01*	0.76
Parks/gyms									
White	3.6 $\pm$ 0.2	3.6 $\pm$ 0.2	3.5 $\pm$ 0.3	3.1 $\pm$ 0.3	3.3 $\pm$ 0.2	3.9 $\pm$ 0.3	0.34	0.63	0.11
African American	3.7 $\pm$ 0.2	3.8 $\pm$ 0.2	3.6 $\pm$ 0.2	3.9 $\pm$ 0.3	3.4 $\pm$ 0.2	4.1 $\pm$ 0.3	0.99	0.05*	0.30
Safe areas									
White	3.9 $\pm$ 0.1	4.2 $\pm$ 0.1	3.9 $\pm$ 0.2	4.2 $\pm$ 0.2	3.9 $\pm$ 0.2	4.1 $\pm$ 0.2	0.97	0.06	0.92
African American	3.8 $\pm$ 0.1	3.9 $\pm$ 0.1	4.0 $\pm$ 0.2	4.0 $\pm$ 0.3	3.6 $\pm$ 0.2	3.6 $\pm$ 0.2	0.11	0.75	0.87
Television watching									
White	3.0 $\pm$ 0.2	2.9 $\pm$ 0.2	3.2 $\pm$ 0.3	3.3 $\pm$ 0.3	3.3 $\pm$ 0.3	3.0 $\pm$ 0.4	0.53	0.54	0.75
African American	4.3 $\pm$ 0.3	3.7 $\pm$ 0.3	3.5 $\pm$ 0.4	3.9 $\pm$ 0.6	4.2 $\pm$ 0.4	4.0 $\pm$ 0.5	0.64	0.77	0.42
Sports teams									
White	0.6 $\pm$ 0.0	0.7 $\pm$ 0.0	0.6 $\pm$ 0.1	0.8 $\pm$ 0.1	0.4 $\pm$ 0.1	0.7 $\pm$ 0.1	0.09	<0.001*	0.62
African American	0.4 $\pm$ 0.0	0.7 $\pm$ 0.1	0.4 $\pm$ 0.1	0.6 $\pm$ 0.1	0.5 $\pm$ 0.1	0.5 $\pm$ 0.1	0.48	<0.01*	0.23

SE, standard error.

\* Active &gt; not active.

<sup>†</sup> Active > not active for normal weight only.

to 14 years) attending a summer fitness camp compared with a reference group of non-overweight youth (ages 10 to 14 years) and found lower levels of parental support and greater body-related barriers to PA. In a study of school children, Trost et al. (32) found that obese sixth grade children reported significantly lower levels of self-efficacy for PA, were involved in significantly fewer community organizations promoting PA, and were significantly less likely to report their father or male caregiver as being physically active. These studies did not evaluate weight-related differences in the correlates of PA while controlling for PA.

Fulkerson (30) compared responses of overweight and non-overweight 9-to-11-year-old girls with factors that seem to influence weight-bearing PA. Overweight girls reported more barriers to, lower assessment of, and had lower self-efficacy for weight-bearing PA. A similar finding was noted by Worsely (50) with Australian children. These authors found that slim children preferred endurance activ-

ities, whereas obese children rated flexibility- or coordination-type activities preferable. Girls in these two studies were predominately white and, in the case of Fulkerson, well educated and of higher income than those in the present study.

Taylor et al. (29) compared scores on a number of correlates of PA between groups of overweight (>85th percentile) and non-overweight (<85th percentile) youth from grades 7 through 12. The overweight girls perceived that they had fewer activity choices, less peer support, greater barriers to activity, and less athletic coordination, and indicated that they enjoyed PA less than non-overweight girls did. In subsequent multivariate analyses, however, none of the correlates measured was significantly associated with PA in the overweight girls. Nonetheless, the authors suggested that interventions for overweight girls may need to target these variables.

Although we previously reported higher scores on certain social-cognitive variables in white girls and lower levels of

PA among African-American girls (23,26,43), we did not in these prior reports examine the interactions of those variables with race and weight status. Although some subsequent studies reported differences in the correlates of PA for overweight girls compared with non-overweight girls, our present analysis indicates that when activity level was included in the analysis, weight status did not modify the relations of several putative correlates of PA.

Scores on five of the six social-cognitive factors were significantly higher for active white girls than for active African-American girls. In addition to perceived behavior control, scores on self-efficacy, attitudes, enjoyment of PA, and enjoyment of PE were significantly higher for the active white girls, regardless of body weight classification. Among the African-American girls, only perceived behavioral control and self-efficacy were associated with activity level. For the environmental scales, regardless of weight group, the active African-American girls scored higher on sports team participation, social provisions, home equipment, and access to parks/gyms scales compared with the low-active girls. Family support scores were also higher in active African-American girls, but only for those classified as normal weight. Only family support and sports team participation were associated with activity level in the white girls. These findings suggest that racial differences between groups of adolescent girls should be considered when PA interventions are developed. Moreover, when programs are designed that focus on weight status, including an assessment of current activity status, they may enable intervention designers to better tailor their efforts to the individual girls.

In a study of the association between rural or urban life and correlates of PA using this cohort, we found that, regardless of home location, access to sports equipment and perceived safety of the neighborhood were evaluated as greater for white girls than for African-American girls (43). However, in contrast, family support was perceived to be greater among African-American girls than for white girls (43). As noted in the current analysis, less access to supportive environments by low-active African-American girls (evidenced by access to parks and gyms, availability of sports equipment, and other social provisions for PA) suggests that these areas are good targets for intervention. Enhanced family support, associated with higher PA, could be particularly relevant in an intervention for at-risk and overweight African-American girls.

Although we observed differences among the correlates of PA for active and low-active girls in the current study, differences were generally low (range among correlates was 0.2 to 1.2 units). The practical significance of these differences, however, should be carefully considered. In a prior analysis, we estimated that 1 SD unit change in perceived behavioral control was associated with a 0.15 SD unit change in vigorous PA (22). Taken as a binomial effect, this represents a change of ~7% to 8% above control. Even

when applied to a subpopulation of girls, this level of change at a population level would be significant. Estimates of such an effect were made by Neumark-Sztainer et al. (51). These investigators estimated that small changes (~20%) in PA correlates could amount to increased PA time between 33 and 72 min/wk. Thus, even small group differences in important activity correlates could be meaningful when employed in a community-based intervention.

Limitations in our study include the use of a self-report measure of PA and use of BMI rather than body composition to assess weight status. However, the strengths of the research outweigh these limitations. Our study is one of the few to evaluate weight-related differences in both social-cognitive and environmental correlates of PA. The study included a large number of girls of similar age and a high proportion of African-American girls. In addition, it classified the girls into three weight categories (including the at-risk group) and differentiated the more active girls from the less active girls.

Improved interventions are needed to reverse the escalating trends in the increased prevalence of overweight and obesity across the United States, especially among young people (11). Most PA interventions have not been effective in increasing the PA levels of youth outside of PE class (52). The results from this study suggest that PA interventions should focus on social-cognitive and environmental variables unique to girls of different activity levels (and races) rather than on their body weight status alone. Factors such as self-efficacy, perceived behavioral control, sports participation, and family support are relevant to all adolescent girls, irrespective of weight status. Distinguishing girls who are already engaged in regular PA from those who are not could produce interventions that more precisely target needs of adolescent girls, including those who are overweight. Targeted interventions, based on factors such as race and activity status, may increase PA level and, as a result, decrease levels of overweight among adolescent girls.

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