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A Prospective Study of the Determinants of Physical Activity in Rural Fifth-Grade Children[1]

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Background. **Understanding the factors that influence physical activity behavior is important in the design of intervention programs targeted at youth.**

Methods. **A prospective study design was used to identify the predictors of vigorous physical activity (VPA) (⩾6 METs) and moderate and vigorous physical activity (MVPA) (⩾3 METs) among 202 rural, predominantly African-American children. Selected social–cognitive determinants of physical activity were assessed via questionnaire in the fifth grade. Participation in VPA and MVPA was assessed via the previous day physical activity recall 1 year later in the sixth grade.**

Results. **For girls, participation in community sports, self-efficacy in overcoming barriers, enjoyment of school physical education, race (white > black), and perception of mother's activity level (active vs inactive) were significant predictors of VPA. For MVPA, participation in community sports and self-efficacy in overcoming barriers were significant predictors. For boys, self-efficacy in overcoming barriers was the only significant predictor of VPA, while beliefs regarding activity outcomes and participation in community sports were significant predictors of MVPA.**

Conclusion. **Social–cognitive constructs such as physical activity self-efficacy, access to community physical activity outlets, and positive beliefs regarding physical activity outcomes are important predictors of future physical activity behavior among rural, predominantly African-American children.**

Key Words: **exercise; sports; self-efficacy; African-American.**

INTRODUCTION

Accumulating evidence indicates that physical activity is important to the short- and long-term health of children and adolescents [*1,2*]. Yet, despite the many benefits of regular physical activity, national surveys conducted over the past decade indicate that sizable percentages of U.S. children and adolescents are low active, suggesting that intervention programs to increase physical activity are needed [*3–6*].

To maximize the effectiveness of such intervention programs, it is important to understand the psychosocial and environmental factors that influence physical activity behavior among youth [*7*]. Presently, however, our knowledge concerning the determinants of youth physical activity is limited. While age and gender have been shown to be strong predictors of activity status among youth [*4,8*], relatively little is known about the more modifiable psychosocial and environmental determinants of activity, particularly among preadolescent children.

Previous investigations involving young children have identified parental support [*9,10*], enjoyment of physical activity [*10*], access to equipment and facilities [*10,11*], and time spent outdoors [*11,12*] as factors associated with activity behavior. However, because these studies involved primarily white children from urban settings, it is not known to what extent these findings are generalizable to African-American children living in rural communities. Moreover, because these studies were cross-sectional in design, a causal relationship between these determinant variables and physical activity behavior cannot be inferred.

To address these gaps in the research literature, the present study examined the predictors of vigorous physical activity and moderate and vigorous physical activity among a cohort of rural, predominantly African-American children. In order to establish temporal relationships between the predictor variables and physical activity behavior, a prospective study design was used. Hence, selected psychosocial and environmental variables measured at baseline (fifth grade) were used to predict physical activity behavior measured at 12-month follow-up (sixth grade).

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METHODS

Subjects

Subjects for this study were 229 fifth-grade students from a single school district in rural South Carolina. Of this group, 202 students provided physical activity data 1 year later in the sixth grade. The demographic characteristics of the sample at 12-month follow-up are displayed in Table 1. The final sample of sixth-grade children was 64% African-American and 55% female, and the median age was 12. Students lost to follow-up were not significantly different from the final sample with respect to any of the demographic and determinant variables. Prior to participation in the study, written informed consent was obtained from each student and his or her primary guardian. The study was approved by the University of South Carolina Institutional Review Board.

Measurement of Physical Activity

Physical activity during the after-school hours was assessed using the previous day physical activity recall (PDPAR). This self-report instrument made use of a standardized form organized into 17 30-min blocks beginning at 3:00 PM and continuing through 11:30 PM. Thirty-five common activities, including sedentary activities such as television watching, eating, and riding in a car or bus, were listed on the form and each student entered the main activity in which he or she participated during each of the 30-min time periods on the previous day. The main activity was defined as the activity which occupied the majority of the 30-min time period. For each 30-min block, the student rated the intensity of the designated activity as very light, light, medium, or hard. Very light activities were described as those requiring slow breathing with little or no movement. Light activities were described as those requiring normal breathing and regular movement. Medium activities were described as those requiring increased breathing and moderate movement. Hard activities were described as those requiring hard breathing and moving quickly. For each level of intensity, students were provided with cartoon illustrations depicting activities typical of each intensity level. The PDPAR has established validity based on concurrent observation with both motion sensors ($r = 0.77$) and heart rate monitors ($r = 0.63$) and established test–retest reliability ($r = 0.98$) [*13*].

Students completed the PDPAR instrument on 3 consecutive days in the classroom under the supervision of two trained staff members. All assessments were completed within a 10-week period during the spring of the cohort's sixth-grade year. During the 12-month follow-up period, students were not exposed to any new or novel intervention programs to promote physical activity. Data from each day were reduced to the average daily number of 30-min blocks in which the main activity was rated at 6 METs or more—vigorous physical activity (VPA)—and 3 METs or more—moderate and vigorous physical activity (MVPA). One MET was defined as the energy expenditure for sitting quietly, which is approximately equal to 3.5 ml oxygen per kilogram of body weight.

TABLE 1
Demographic Characteristics of the 202 Sixth-Grade Students

Variable	All ($N = 202$) (%)	Boys ($N = 92$) (%)	Girls ($N = 110$) (%)
Race/ethnicity			
African-American	64.4	60.9	67.3
White	35.6	39.1	32.7
Age (years)			
11	43.6	41.3	45.4
12	49.5	51.1	48.2
13	5.9	5.4	6.4
14	1.0	2.2	0.0

Determinants of Physical Activity

The determinant variables for this study were selected on the basis of social cognitive theory [*14*] and were classified as demographic, psychosocial, or environmental determinants of physical activity behavior.

Psychosocial variables. Hypothesized psychosocial determinants of physical activity included physical activity self-efficacy, which had three dimensions—support seeking, overcoming barriers, and competing activities, social influences regarding physical activity, and beliefs about physical activity outcomes. Items for the physical activity self-efficacy scales were taken from the scale developed by Reynolds et al. [*15*]. Additional items were constructed from a list of potential barriers to physical activity among children and adolescents [*16*]. The social influences scale was modeled on the scale developed by Reynolds et al. [*15*], while the beliefs about physical activity outcomes scale was developed by the investigators. A brief description of the psychosocial determinant variables and their psychometric properties is provided in Table 2. The complete psychometric properties and factor structure of these scales have been reported elsewhere [*17*].

Environmental variables. Students completed a series of single items designed to measure hypothesized environmental determinants of activity behavior including perceived physical activity habits of parents and peers, like or dislike of physical education, access to sporting and fitness equipment at home, participation in school sports, participation in community sports, and involvement in community physical activity organizations. In addition, the PDPAR was used to

TABLE 2
Psychometric Properties of Scales Used to Measure Psychosocial Determinant Variables

Scale[a]	Cronbach's α	Test–retest reliability	Concept/sample items
Beliefs			Beliefs about consequences of being physically active.
Beliefs—outcomes (11 items, range 0–11)	0.75	$r = 0.51$	If I were to be physically active most days it would: • Get or keep me in shape. • Help keep me healthy. • Be fun.
Social influences (8 items, range 0–8)	0.75	$r = 0.78$	Influence of family and friends on physical activity. A friend/someone in my family has: • Encouraged me to be physically active. • Been physically active with me.
Self-efficacy			Confidence in ability to be physically active.
Support seeking (7 items, range 0–7)	0.71	$r = 0.76$	I think I can: • Ask my parent or other adult to take me to a physical activity or sport.
Overcoming barriers (4 items, range 0–4)	0.71	$r = 0.82$	• Be physically active even if I have a lot of homework.
Competing activities (6 items, range 0–6)	0.54	$r = 0.61$	• Be physically active even if I could watch TV or play video games instead.

[a] All items measured on dichotomous scale ("Yes" or "No").

estimate the number of 30-min blocks in which the main activity was television watching or playing video games.

Statistical Analyses

The predictors of VPA and MVPA were identified using forward stepwise multiple linear regression. The significance level for entry into the regression model was set at 0.05. To improve the normality and homoscedasticity of the residuals, a log transformation was applied to both the VPA- and the MVPA-dependent variables. Because previous investigations have identified gender differences in the determinants of physical activity [*9,10,15*], and because preliminary analyses revealed gender to be the single most important predictor of activity status, accounting for 11–13% of the variance in activity behavior, separate analyses were performed for girls and boys. All were conducted with SAS (Version 6.08).

RESULTS

Mean activity scores for boys and girls are shown in Fig. 1. Boys reported significantly greater participation in VPA, with the mean number of 30-min blocks with activity rated at 6 METs or greater being 2.8 ± 1.9 and 1.6 ± 1.4 for boys and girls, respectively. Similarly, boys reported significantly greater participation in MVPA with the mean number of 30-min blocks with activity rated at 3 METs or greater being 3.7 ± 1.9 and 2.6 ± 1.7 for boys and girls, respectively.

Descriptive statistics for the continuous and categorical determinant variables are shown in Tables 3 and 4, respectively. On average, boys and girls scored similarly on each of the determinant variables with the exception of beliefs about physical activity outcomes (girls > boys), enjoyment of physical education (boys > girls), and perceived activity level of best friend (girls > boys).

Bivariate Associations

Zero-order correlation coefficients between each of the determinant variables and VPA and MVPA (log transformed) are shown in Table 5. For boys, self-efficacy (overcoming barriers), beliefs regarding physical activity outcomes, and social influences regarding

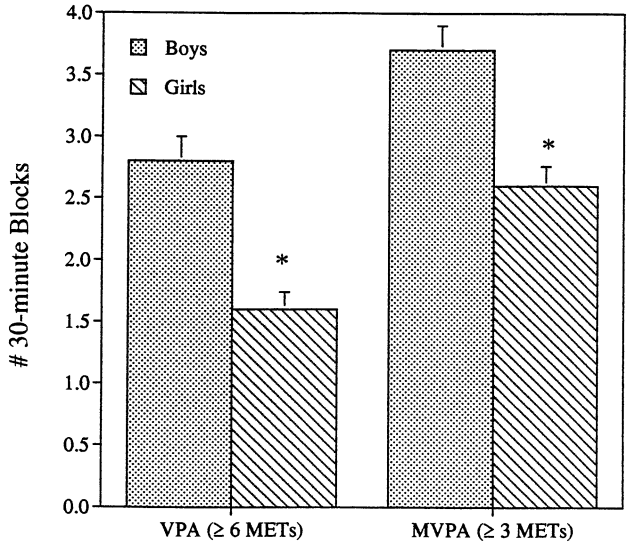

FIG. 1. Vigorous and moderate and vigorous physical activity by gender. *Denotes significant gender difference, $P < 0.001$. VPA, vigorous physical activity; MVPA, moderate and vigorous physical activity.

TABLE 3
Means and Standard Deviations for the Continuous Determinant Variables

Variable	All	Girls	Boys
Self-efficacy			
Support seeking	6.3 ± 1.1	6.4 ± 1.1	6.2 ± 1.1
Barriers	2.5 ± 1.3	2.4 ± 1.4	2.6 ± 1.2
Competing activity	5.6 ± 1.3	5.6 ± 1.3	5.7 ± 1.2
Beliefs—outcomes	9.6 ± 1.8	9.9 ± 1.6*	9.3 ± 1.9
Social influences	4.9 ± 2.2	5.0 ± 2.1	4.7 ± 2.3
Home equipment	7.0 ± 2.5	7.0 ± 2.5	7.0 ± 2.5
School sports	1.6 ± 1.0	1.6 ± 1.1	1.7 ± 1.0
Community sports	2.2 ± 1.2	2.1 ± 1.2	2.4 ± 1.3
Community organizations	2.5 ± 1.5	2.4 ± 1.3	2.7 ± 1.6
TV/video games	3.3 ± 1.8	3.1 ± 1.9	3.6 ± 1.8

* Significant gender difference $P < 0.05$.

physical activity were significant correlates of VPA. For girls, self-efficacy (overcoming barriers), community sports, perception of mother's activity level (active vs inactive), race/ethnicity (white vs African-American), and enjoyment of school physical education were significant correlates of VPA.

With respect to MVPA, self-efficacy (support seeking), self-efficacy (overcoming barriers), beliefs regarding physical activity outcomes, social influences regarding physical activity, and community sports teams were significant correlates among boys. For girls, self-efficacy (overcoming barriers), community sports teams, race/ethnicity, and enjoyment of school physical education were significant correlates of MVPA.

Regression Models VPA. Results of the stepwise regression analyses for VPA are shown in Table 6. For girls, participation in community sports teams, self-efficacy in overcoming barriers, enjoyment of physical education, race/ethnicity, and perception of mother's activity entered the regression model at the 0.05 level, accounting for 26% of the variance in VPA. For boys, self-efficacy in overcoming barriers was the only significant predictor of VPA, accounting for just over 5% of the variance.

MVPA. Results of the stepwise regression analyses for MVPA are shown in Table 7. For girls, self-efficacy in overcoming barriers and number of community sports teams entered the regression model at the 0.05 level, accounting for 17% of the variance in MVPA. For boys, beliefs regarding physical activity outcomes and number of community sports teams entered the regression model at the 0.05 level, accounting for 17% of the variance in MVPA.

TABLE 4
Descriptive Statistics for the Categorical Determinant Variables

Variable	All (%)	Girls (%)	Boys (%)
Mother active (yes)	55.5	57.3	53.3
Father active (yes)	64.4	60.9	68.5
Best friend active (yes)	93.1	96.4*	89.1
Like PE (yes)	75.8	65.5*	88.0

* Significant gender difference $P < 0.05$.

TABLE 5
Bivariate Associations for the Determinant Variables and Physical Activity Behavior

	VPA		MVPA	
	Boys	Girls	Boys	Girls
Race/ethnicity	−0.05	0.26*	−0.01	0.21*
Age	0.11	−0.11	0.18	−0.08
Support seeking[a]	0.17	0.11	0.31*	0.07
Overcoming barriers[a]	0.23*	0.27*	0.23*	0.26*
Competing activities[a]	0.01	0.13	0.04	0.09
Beliefs—PA outcomes	0.22*	0.09	0.32*	0.08
Social influences	0.23*	0.14	0.25*	−0.01
Home equipment	0.10	0.15	0.17	0.12
School sports	0.10	0.09	0.05	0.11
Community sports	0.11	0.28*	0.21*	0.31*
Community organizations	0.02	0.13	0.04	0.16
TV/video games	0.01	−0.09	−0.03	−0.10
Mother's activity	−0.08	0.22*	−0.07	0.09
Father's activity	0.08	0.01	0.05	−0.02
Friend's activity	0.01	0.02	0.05	−0.08
Like school PE	0.02	0.26*	−0.12	0.21*

Note. VPA, vigorous physical activity (≥6 METs); MVPA, moderate and vigorous physical activity (≥3 METs).
[a] Subscale for physical activity self-efficacy.
* Statistically significant $P < 0.05$.

Item Analysis

Because self-efficacy in overcoming the barriers to physical activity was such an important predictor of

TABLE 6
Stepwise Regression Models for Vigorous Physical Activity (≥6 METs)

Step	Variable	β	Partial R^2	Model R^2	F	P value
			Girls			
1	Community sports	0.11	—	0.079	9.27	0.003
2	S.E. barriers	0.07	0.077	0.156	9.77	0.002
3	Like PE	0.23	0.036	0.192	4.71	0.032
4	Race/ethnicity	0.23	0.036	0.228	4.92	0.029
5	Mother's activity	0.19	0.036	0.258	4.14	0.045
			Boys			
1	S.E. barriers	0.10	—	0.053	5.07	0.027

Note. S.E. barriers, self-efficacy in overcoming barriers to physical activity.

TABLE 7

Stepwise Regression Models for Moderate and Vigorous Physical Activity (≥3 METs)

Step	Variable	β	Partial R^2	Model R^2	F	P value
			Girls			
1	Community sports	0.14	—	0.095	11.31	0.001
2	S.E. barriers	0.10	0.072	0.167	9.29	0.003
			Boys			
1	Beliefs/ outcomes	0.07	—	0.106	10.62	0.002
2	Community sports	0.08	0.069	0.174	9.28	0.008

Note. S.E. barriers, self-efficacy in overcoming barriers to physical activity.

activity behavior among both girls and boys, an individual item analysis was conducted to examine which items on this scale most strongly correlated with future physical activity. The results showed clear gender differences. As shown in Table 8, confidence in overcoming the barriers related to homework obligations and feelings of fatigue were the most salient predictors of VPA in the girls, while for boys, confidence in one's ability to be active despite poor weather conditions was the most salient predictor of VPA. A similar pattern was observed for MVPA.

DISCUSSION

The present investigation used a prospective study design to identify the predictors of physical activity behavior among rural, predominantly African-American children. Therefore, in contrast to previous determinant studies involving young children, we were able to establish temporal relationships between the determinant variables and physical activity behavior. Also, in accordance with recent research recommendations [*7*], we performed parallel analyses to determine the predictors of both VPA (≥6 METs) and MVPA (≥3 METs). Using this design, we identified gender, physical activity self-efficacy, participation in community sports, and beliefs regarding physical activity outcomes as important predictors of physical activity behavior.

A major finding of the present study was the significant relationship between self-efficacy in overcoming barriers and future physical activity behavior. Among girls, confidence in overcoming barriers explained approximately 8% of the variance in both vigorous and moderate and vigorous activity, while for boys, confidence in overcoming barriers was the sole predictor of vigorous activity. Interestingly, however, item analysis of the overcoming barriers subscale revealed striking gender differences in relation to the items that most strongly predicted activity behavior. For girls, items related to tiredness and homework obligations were the most important predictors, while for boys, only the item concerning outdoor weather conditions was related to activity behavior.

Previous investigations involving adults [*18,19*] and high-school-age adolescents [*15,20*] have shown self-efficacy to be associated with physical activity behavior. However, to date, researchers have been unable to replicate this finding among younger children [*10,21*]. Thus, our observation of a significant relationship between self-efficacy in overcoming barriers and future physical activity behavior among elementary school children is particularly noteworthy. This suggests that parents, teachers, other significant adults, and where possible, peers should assist low-active children in overcoming traditional barriers to physical activity such as time constraints, homework obligations, and feelings of fatigue. The results of the item analysis further suggest that the barriers to physical activity be addressed on a gender-specific basis.

Another important predictor of physical activity behavior was participation in community sports. Among girls, community sports was the strongest predictor of both vigorous and moderate and vigorous physical activity, accounting for approximately 8 and 10% of the variance, respectively. Community sports participation was also a significant predictor of moderate and vigorous activity among boys, accounting for approximately 7% of the variance. This suggests that one potentially effective way to increase physical activity among youth is to facilitate greater access to community-based physical activity outlets such as YMCA youth sports/fitness programs, summer parks and recreation programs, and local boys and girls clubs. To help with this process, schools should establish links with community

TABLE 8

Pearson Zero-Order Correlation Coefficients for Individual Items in the Self-Efficacy Overcoming Barriers Subscale

Item	VPA[a]		MVPA[a]	
	Boys	Girls	Boys	Girls
Active even if it is very hot or cold outside.	0.26*	0.05	0.27*	0.06
Active even if I have a lot of homework.	0.15	0.30*	0.13	0.29*
Active no matter how busy my day is.	0.12	0.16	0.10	0.14
Active no matter how tired I may feel.	0.10	0.27*	0.05	0.23*

Note. VPA, vigorous physical activity (≥6 METs); MVPA, moderate and vigorous physical activity (≥3 METs).

[a] Variable has been log transformed.

* Statistically significant $P < 0.05$.

sports and recreation leaders so that parents and students can become more aware of the physical activity opportunities available in their community. In addition, pediatric health-care providers should act as advocates for physical activity by regularly counseling young patients about the benefits of physical activity and by referring low-active youth to appropriate community physical activity programs.

The results of this study indicate that, in some instances, the determinants of physical activity vary considerably across genders and levels of intensity. Race/ethnicity was a significant predictor of vigorous activity among girls (whites being more active than African-Americans), but was not related to activity behavior among boys. Enjoyment of school physical education and perception of mother's activity level were found to be significant predictors of activity behavior, but only for girls, and only for vigorous physical activity. Conversely, beliefs regarding physical activity outcomes were a significant predictor of activity behavior, but only for boys, and only for moderate and vigorous physical activity. Also, as was noted above, the item analysis of the self-efficacy overcoming barriers subscale revealed important gender differences with respect to which barriers were related to future activity behavior. Collectively, these observations underscore the need for policy makers and public health practitioners to consider potential gender- and physical activity intensity-related differences when designing and implementing physical activity intervention programs. For example, our findings in relation to girls suggest that physical educators should consider modifying existing school physical education programs to accommodate the needs and interests of young girls. In particular, girls should be provided with opportunities to participate in noncompetitive lifelong activities such as walking, calisthenics/resistance training, and aerobic dance. Conversely, for interventions directed at boys, it appears necessary to educate low-active boys about the proximal benefits of physical activity (i.e., better at sports) and to cultivate positive beliefs about physical activity by providing low-active boys with enjoyable, developmentally appropriate physical activity experiences.

In the present study, we were able to explain more variance in vigorous physical activity among girls (25.8%) than among boys (5.3%). However, it is important to note that, for both gender groups, most of the variance in physical activity behavior remained unexplained. Consequently, additional studies are needed to identify other potentially important psychosocial, environmental, and physiological determinants of physical activity in youth. Our findings in relation to boys may in part be explained by the higher prevalence of vigorous physical activity behavior among boys relative to girls. Nevertheless, further research regarding the determinants of vigorous activity behavior among preadolescent boys is warranted.

In conclusion, physical activity self-efficacy, participation in community sports, and beliefs regarding physical activity outcomes were found to be important predictors of physical activity behavior in rural youth. This suggests that physical activity intervention studies involving rural, predominantly African-American children should endeavor to boost self-efficacy in overcoming barriers to physical activity, increase access to community sports and recreation programs, and instill positive beliefs regarding physical activity outcomes. However, because much of the variance in physical activity behavior remained unexplained, research efforts to elucidate the determinants of physical activity in youth must be continued.

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