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## Association between School- and Nonschool-Based Activity Programs and Physical Activity in Adolescent Girls

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### Abstract

**Background**—Some researchers have questioned if activity programs would be more effective if based outside school (eg, community leagues) rather than within schools. This study compared participation in activity programs based within and outside of school, and estimated the associations between participation and moderate-vigorous physical activity (MVPA) among adolescent girls.

**Methods**—Within the Trial of Activity for Adolescent Girls, independent samples of 1559 6th-grade girls (age 11 to 12) and 3282 8th-grade girls (age 13 to 14) reported program participation using questionnaires. MVPA was measured using accelerometers. Linear mixed models accounted for school and site clustering.

**Results**—Sixth-grade girls reported 5 times as many programs outside school as within school (4.1 vs. 0.8); daily MVPA was 0.29 minutes higher (1.2% of the mean) for each additional program outside school. Compared with 6th-grade girls, 8th-grade girls participated in 1.3 fewer programs outside school, while programs' association with MVPA was unchanged. Conversely, school programs' association with MVPA was greater in 8th grade. Daily MVPA was 1.33 minutes higher per school program, and participation declined 0.13.

**Conclusion**—Programs within and outside schools can both increase activity among adolescent girls. Intervention research should focus on increasing participation in school programs, and increasing movement during programs outside school.

### Keywords

accelerometry; intervention; sports; community

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The majority of adolescents in the United States do not engage in recommended amounts of physical activity,<sup>1</sup> contributing to a high prevalence of diabetes, hypertension, dyslipidemia, and overweight and obesity among adolescents.<sup>2</sup> Activity levels are particularly low among females; the 2007 national Youth Risk Behavior Survey found that only 25.6% of girls in grades 9 to 12 (generally age 14 to 18) reported 60 minutes of activity on 5 days in the previous week, compared with 43.7% of boys.<sup>1</sup> Activity levels also decline throughout adolescence,<sup>3–6</sup> underscoring the need for intervention and retention at an early age.

Several national health organizations have called for schools to take a leadership role in promoting physical activity.<sup>7–9</sup> Schools provide organization, support, and structure to

facilitate participation in a variety of activities, including physical education (PE) classes, interscholastic and intramural sports, recess, and active transport to and from school. School-based interventions are also a vehicle for reaching students who have few activity resources outside of school. School-based physical activity opportunities have been threatened by the growing focus on academic achievement,<sup>10</sup> but a systematic review concluded that there is no evidence that PE participation impairs academic achievement<sup>11</sup> and several studies found that physical activity and academic achievement were positively associated.<sup>12–15</sup>

Despite this support for school-based interventions, other researchers have questioned whether schools are the optimal setting for physical activity promotion. A review of correlates of adolescent activity found that participation in community sports was a consistent positive correlate, but participation in school sports was not.<sup>16</sup> Bungum and Vincent argued that the competitive nature of school sports teams may make them ineffective for students lacking the skill or interest in competition.<sup>17</sup> This may be of particular relevance to adolescent females, who tend to prefer individual, noncompetitive activities<sup>18,19</sup> and do not view competition as one of the primary benefits of physical activity.<sup>20</sup>

Though the effectiveness of school-based activity programs has been questioned, few studies have compared school and nonschool-based programs with respect to participation levels or impact on physical activity or anthropometric outcomes. We are aware of only 2 studies that examined these issues in girls,<sup>21,22</sup> and those studies focused on girls who had not reached the teen years. O'Loughlin et al found that playing no sports outside of school predicted excess weight gain among elementary schoolgirls, but participation in school sports did not, while Trost et al found that community sports were associated with physical activity among 5th-grade girls, but school sports were not. Other authors<sup>6,23</sup> have documented, however, that program participation patterns change throughout adolescence, as participation in “unstructured” or “non-organized” activities declines while participation in “structured” or “organized” activities tends to remain stable. Therefore, the effectiveness of schools as a venue for activity promotion may be modified by age.

The latter finding led us to hypothesize that participation in school programs would be constant in adolescents of different ages, but participation in nonschool programs would decline with age. We also hypothesized that participation in either type of program would be positively associated with activity levels across different ages. To our knowledge, these hypotheses have not been tested in adolescent girls. Given the conflicting evidence regarding the effectiveness of school programs to provide quality activity, a test of these hypotheses is needed.

## Methods

### Subjects

Data were obtained as part of the Trial of Activity for Adolescent Girls (TAAG), a group-randomized controlled trial designed to test an intervention to reduce the decline of physical activity in middle school girls.<sup>24,25</sup> Six middle schools were recruited from each of 6 field centers (the Universities of Arizona, Maryland, Minnesota, and South Carolina; San Diego State University; and Tulane University) for a total of 36 schools. The study was coordinated by the University of North Carolina–Chapel Hill and the National Heart, Lung, and Blood Institute (NHLBI). The trial was funded by NHLBI.

Data for this analysis were from 2 independent, random cross-sectional samples. Sixty 6th-grade girls per school were recruited in Spring 2003, and 90 to 120 8th-grade girls per

school were recruited in Fall 2006. Consent was provided by 80% of 6th-grade girls (n = 1721) and 89% of 8th-grade girls (n = 3502). An additional 8th-grade sample was recruited in Fall 2005, but this took place while activity programs were being aggressively promoted with the assistance of study staff. We elected to focus our analysis on the 2006 sample, during the sustainability phase of the intervention<sup>26</sup> in which study staff were no longer directly involved in program promotion, to make our results more representative of the natural program settings for this age group.

From the 6th- and 8th-grade samples, we excluded those missing data on program participation (n = 12 and 35, respectively) or physical activity (n = 113 and 96, respectively). We compared participation levels among those missing activity data to the rest of the sample, and likewise examined activity levels among those missing participation data, and found no significant differences. We further excluded the top 1% of the distribution of school and nonschool program participation in each sample to correct for over-reporting of activity, which is often found in adolescent girls.<sup>27–29</sup> The final sample sizes of the 6th- and 8th-grade samples were 1559 and 3282, respectively.

### Physical Activity

Measurements took place in Spring 2003 and Spring 2006. Physical activity was measured with the MTI Actigraph accelerometer (Ft. Walton Beach, FL). Accelerometers are a more valid activity measure for adolescents than self-reports, the validity of which has been widely questioned.<sup>29–32</sup> A review of accelerometer models found that the MTI Actigraph was the only commercially-available model that was proven to correlate with energy expenditure as measured by doubly labeled water.<sup>33</sup>

Trained personnel from the study fit the Actigraphs worn at the waist level (over the anterior superior iliac spine) and instructed girls to wear it during waking hours for 7 days, except during activities in which it could get wet or when competitive sports required its removal. Accelerometers were initialized to begin collecting data at 5:00 AM on the day after they were distributed, providing 6 complete days of data. Girls were included in the analysis if they had at least 1 full day of data, out of the potential 6 days. Missing accelerometry data within the 6 days were replaced using an imputation model described elsewhere.<sup>35</sup> On average, approximately 12 hours of data per girl were imputed over the 6 days. Activity was measured by the accelerometer in 30-second epochs. The count thresholds (counts·30sec<sup>-1</sup>) for moderate physical activity were set at 1500 to 2600. This threshold represents approximately 4.6 metabolic equivalents (METs) and was found to best discriminate between slow and brisk walking in a sample of 8th-grade girls who participated in TAAG.<sup>34</sup> The count thresholds for vigorous physical activity (VPA) were set at > 2600, or 6.5 METS, which was found to best discriminate between brisk walking and running.

### Program Participation

Girls reported their participation in school and nonschool sports, classes, and lessons through a written questionnaire. The questionnaire listed 14 sports and asked respondents to indicate those in which they had participated at school in the previous year and, in a separate column, those in which they had participated outside of school in the previous year. For each setting, girls had the option of reporting 1 sport that was not listed. The questionnaire also listed 17 activity-related classes/lessons and asked girls to mark those in which they had participated outside of school in the previous year, and up to 1 class or lesson that was not listed. We use the term “nonschool programs” here to represent the sum of classes/lessons and sports outside of school and “school programs” to represent the sum of sports at school. To clarify, however, “programs” was not used in the questionnaire. Girls also reported their

race (White, non-Hispanic; Black, non-Hispanic; Hispanic; Other, non-Hispanic) on the questionnaire.

All instruments were distributed at the girls' school, and all procedures were approved by the institutional review boards at each field center.

### Statistical Analyses

All analyses were based on the general linear mixed model. School and field center were included in all models as random effects, to account for group randomization. All other variables were treated as fixed effects. All models adjusted for race; body mass index (BMI), calculated from height and weight measured by trained staff, and family structure were evaluated as potential confounders, but neither appreciably changed results and thus they were not retained. Analyses were conducted with SAS version 9.1 (SAS Institute, Cary, NC).

Because 8th-grade girls in the intervention group had been exposed to TAAG, differences between grades could potentially be affected by the intervention. In all models that included 8th-grade data, we tested for an interaction between intervention assignment and the independent variable of interest ( $\alpha = .10$ ) to evaluate whether the association of interest differed between intervention and control girls. The interaction term was not significant in any model and was subsequently removed, but treatment group was retained as a main effect in each model.

### Results

Descriptive statistics of the 6th- and 8th-grade samples are provided in Table 1. Both samples were racially diverse, with comparable distributions. Activity levels were lower in the 8th-grade sample (21.7 minutes of MVPA per day) compared with 6th grade (23.6 minutes of MVPA per day). Conversely, mean BMI was higher in the 8th-grade sample (22.8 vs. 20.9).

The number of programs in which girls participated was regressed on grade and race to test if participation levels differed between grades (Table 2). Separate models were used to examine differences in school and nonschool programs. Eighth-grade girls reported participating in significantly fewer school and nonschool programs compared with 6th-grade girls ( $P < .001$ ). The mean number of nonschool programs was much higher than school programs in both grades, but the proportionate decrease across grades was also greater. Participation in nonschool programs declined from 4.1 to 2.7—a 32% decline—while participation in school programs declined from 0.81 to 0.66, or 16%.

To estimate the association between program participation and activity in each grade, mean daily MVPA was regressed on the number of programs in which girls participated, race, and intervention assignment (8th grade only). Swimming was not included as a program for this part of the analysis because it is not captured by accelerometers. We explored modeling programs by tertile, using categorical variables to account for a nonlinear relationship, but this did not improve the model fit. School and nonschool programs were initially tested in separate models (Model I), and then together in a single model (Model II) to assess whether the effect of programs in one setting is confounded by programs in another setting.

In 6th grade, both school and nonschool programs were significantly associated with MVPA in Model I, but only nonschool programs were significantly associated in Model II (Table 3). Each additional nonschool program was associated with 0.29 more minutes of MVPA per day, or 1.2% of the mean activity level in this sample, after adjusting for race and school

programs. The 8th-grade association between nonschool programs and MVPA was significant and of a slightly greater magnitude ( $\beta = 0.42$ , or 1.9% of the mean 8th-grade activity level). School programs had a much stronger association with MVPA in 8th grade compared with 6th grade. Each additional school program was associated with a 1.33-minute increase in daily MVPA, or 6.1% of the mean activity level in this sample ( $P < .001$ ).

The analysis was repeated using VPA as the dependent variable. Results are displayed in Table 4 and largely reflect those in Table 3. School programs were nonsignificant in 6th grade, but highly significant in 8th grade ( $P < .001$ ). Among 8th graders, participation in 1 school program was associated with 0.40 more minutes of VPA per day, or 8.1% of the mean activity level in this sample. Nonschool programs were significant in both grades, but the increase in VPA associated with 1 program represented only 2.4% and 3.1% of activity levels in 6th and 8th grade, respectively.

## Discussion

Overall, girls who participated in more activity programs were more physically active regardless of whether programs were based at school or away from school. The relative importance of the different settings varied between 6th and 8th grade, however. The role of nonschool programs appeared to diminish with increasing grade level, as their association with activity was only slightly higher in 8th grade, but participation levels were 32% lower. Participation in school programs remained fairly stable across grades, but its association with activity was substantially higher in 8th grade compared with 6th grade. The relative stability of school program participation is similar to the results of previous studies in which participation in nonorganized activities declined throughout adolescence, but participation in organized activities remained stable.<sup>6,23</sup>

This difference across grades in the association between programs and activity suggests that school and nonschool programs may serve different types of girls or serve different functions across grades. The differential effect of school programs between 6th and 8th grade may reflect that the competitive nature of school activities changes over time. Girls still participating in school programs in the 8th grade may be more athletic and involved in more rigorous sport competitions in the programs, and may be preparing for varsity sports. Such a population shift may account for the stronger association in 8th grade, but a longitudinal study would be needed to test this hypothesis. Regardless, these results suggest that school programs have a valuable function among 8th-grade girls. Schools may have more adequate facilities, experienced physical education teachers as coaches, organizational capacity, and easier access to programs that do not require additional transportation to another location.

We found that girls participate in approximately 3 times as many nonschool programs as school programs in 8th grade, but need to participate in 3 times as many nonschool programs to get as many minutes of activity as they get from 1 school program. This may indicate that nonschool programs simply do not last as long, or that girls do not spend as much time moving during their nonschool programs. There may be an opportunity to increase activity levels in nonschool programs by training program leaders to improve quality of instruction, resulting in increased movement time. Similar training of Physical Education specialists has resulted in increased levels of activity during PE classes.<sup>36,37</sup> Nonschool programs may provide alternative physical activity opportunities that involve being part of a team that is less competitive. They are a way for less-athletic girls to participate in sports at a more reasonable fee. Nonschool programs may also offer girl-friendly benefits such as being active in a safe and supervised setting that has been familiar since childhood, while having a chance to socialize.<sup>38</sup> Since girls' physical activity levels

decrease during adolescence, the quality of activity in nonschool programs may be an opportunity for future research.

### Study Limitations and Strengths

Major strengths of our study included the use of accelerometers and adolescent gender-specific accelerometer cut-points that were generated from a sample similar to the study population.<sup>34</sup> Our study also benefited from a national, multisite sample that was racially and socioeconomically diverse. The primary limitation was the cross-sectional design, which precludes us from examining patterns of change within girls as they moved from 6th to 8th grade. In addition, adolescent girls are known to over-report activity,<sup>27,28</sup> and may have over-reported program participation in this study. We excluded girls who reported unusually high participation, but girls who reported lower levels of participation could also have over-reported and consequently biased the results. Furthermore, if girls were not able to recall nonschool programs as accurately as school programs, this may explain why the association between nonschool programs and physical activity was relatively weak. Another limitation is that we did not measure time spent in each program, and thus could not assess whether the relatively weak association between nonschool programs and activity is due more to the length of these programs or girls' lack of movement while participating. The weak associations could also be due to the fact that the measures of program participation and physical activity were measuring different time frames (1 year and 6 days, respectively). Finally, accelerometry is not a perfect measure of physical activity because it depends on participant compliance and does not capture upper body movement.

### Conclusions

The results of the study suggest that both school and nonschool programs have a role in facilitating physical activity in adolescent girls. Community-based programs should continue as good participation in these programs is seen both in 6th and 8th grade, but future research should examine girls' level of activity during such programs. School-based programs appear to be important sources of activity for older girls. Increasing participation in school programs among 8th-grade girls may provide more structured physical education and sports training since physical education specialists are more likely to deliver the school programs, resulting in higher levels of movement for girls involved. School stakeholders may consider designing those programs for a wider range of physical and athletic abilities. Intervention research and community programming should not only encourage girls to participate in school and nonschool activities, but also identify strategies to maximize movement and fun during the program time and reach out to girls of varying athletic abilities.<sup>39</sup>

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**Table 1**  
**Descriptive Statistics of 6th- and 8th-Grade Participants, Trial of Activity for Adolescent Girls**

|                                | 6th grade (n = 1559) | 8th grade (n = 3282) |
|--------------------------------|----------------------|----------------------|
| Age (yrs)                      | 11.8 (0.5)           | 14.0 (0.5)           |
| BMI                            | 20.9 (4.9)           | 22.8 (5.4)           |
| MVPA per day (min)             | 23.6 (11.8)          | 21.7 (11.3)          |
| VPA per day (min)              | 5.6 (4.6)            | 4.9 (4.1)            |
| Race/ethnicity (%)             |                      |                      |
| White, non-Hispanic            | 45.0                 | 46.6                 |
| Black, non-Hispanic            | 21.6                 | 17.9                 |
| Hispanic                       | 21.6                 | 22.5                 |
| Other, non-Hispanic            | 11.9                 | 13.1                 |
| Live with parents (%)          |                      |                      |
| Both                           | 71.3                 | 70.5                 |
| Mother only                    | 24.6                 | 24.4                 |
| Father only                    | 1.8                  | 3.4                  |
| Neither                        | 2.4                  | 1.7                  |
| Free/low-cost school lunch (%) |                      |                      |
| Yes                            | 41.7                 | 35.4                 |
| No                             | 45.7                 | 56.6                 |
| Don't know                     | 12.6                 | 7.9                  |

Abbreviations: BMI, body mass index; MVPA, moderate-vigorous physical activity; VPA, vigorous physical activity.

**Table 2**  
**Number of Programs in 6th- and 8th-Grade Participants, and Test for Difference Between Grades**

| Program setting     | 6th grade | 8th grade | Difference * | 95% CI       |
|---------------------|-----------|-----------|--------------|--------------|
| School—mean (SD)    | 0.8 (1.3) | 0.7 (1.0) | -0.13**      | -0.06, -0.20 |
| School—tertile      |           |           |              |              |
| Low (0)             | 59.8      | 60.0      |              |              |
| Medium (1)          | 20.8      | 24.3      |              |              |
| High (>1)           | 19.4      | 15.7      |              |              |
| Nonschool—mean (SD) | 4.1 (3.7) | 2.7 (2.6) | -1.3**       | -1.1, -1.5   |
| Nonschool—tertile   |           |           |              |              |
| Low (0-2)           | 43.8      | 57.9      |              |              |
| Medium (3-5)        | 29.1      | 28.5      |              |              |
| High (>5)           | 27.1      | 13.6      |              |              |

\* General linear mixed models tested the association between grade and number of programs girls reported participating in, adjusted for race; school and field center were included as random effects.

\*\*  $P < .001$ .

**Table 3**  
**Association of Program Participation With Daily Minutes of MVPA Among 6th- and 8th-Grade Participants**

|                        | Model I* |            |        | Model II* |             |        |
|------------------------|----------|------------|--------|-----------|-------------|--------|
|                        | $\beta$  | 95% CI     | P      | $\beta$   | 95% CI      | P      |
| 6th grade              |          |            |        |           |             |        |
| School                 | 0.53     | 0.08, 0.98 | 0.02   | 0.28      | -0.19, 0.76 | 0.24   |
| Nonschool              | 0.33     | 0.16, 0.50 | <0.001 | 0.29      | 0.11, 0.47  | 0.002  |
| 8th grade <sup>a</sup> |          |            |        |           |             |        |
| School                 | 1.56     | 1.19, 1.93 | <0.001 | 1.33      | 0.95, 1.72  | <0.001 |
| Nonschool              | 0.54     | 0.39, 0.70 | <0.001 | 0.42      | 0.26, 0.58  | <0.001 |

\* General linear mixed models tested the association between grade and number of programs girls reported participating in, adjusted for race; school and field center were included as random effects. School and nonschool programs were tested separately.

\*\* School and nonschool programs were tested in the same model.

<sup>a</sup> Further adjusted for intervention assignment.

**Table 4**  
**Association of Program Participation With Daily Minutes of VPA Among 6th- and 8th-Grade Participants**

|                        | Model I* |             |        | Model II* |             |        |
|------------------------|----------|-------------|--------|-----------|-------------|--------|
|                        | $\beta$  | 95% CI      | P      | $\beta$   | 95% CI      | P      |
| 6th grade              |          |             |        |           |             |        |
| School                 | 0.16     | -0.02, 0.34 | 0.08   | 0.06      | -0.12, 0.25 | 0.50   |
| Nonschool              | 0.14     | 0.07, 0.21  | <0.001 | 0.13      | 0.06, 0.21  | <0.001 |
| 8th grade <sup>a</sup> |          |             |        |           |             |        |
| School                 | 0.48     | 0.33, 0.62  | <0.001 | 0.40      | 0.25, 0.54  | <0.001 |
| Nonschool              | 0.19     | 0.13, 0.25  | <0.001 | 0.15      | 0.09, 0.21  | <0.001 |

\* General linear mixed models tested the association between grade and number of programs girls reported participating in, adjusted for race; school and field center were included as random effects. School and nonschool programs were tested separately.

\*\* School and nonschool programs were tested in the same model.

<sup>a</sup> Further adjusted for intervention assignment.