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ARTICLE

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ABSTRACT

OBJECTIVES. Physical activity may be constrained or facilitated by local environments. The availability of neighborhood facilities for physical activity may be particularly relevant for youth, who are unable to drive and whose activity is often limited to the immediate distance they are able to walk or bicycle. Several studies have shown that proximity to recreational facilities and parks is one of the most important predictors of physical activity. Because the United States already has an extensive infrastructure of parks, with 70% of adults indicating that they live within walking distance of a park or playground, parks may be a potential venue for increasing physical activity. This might be particularly important for adolescent girls, whose physical activity levels decline substantially as they go through puberty. The goal of this study was to examine the association between park proximity, park type, and park features and physical activity in adolescent girls.

PATIENTS AND METHODS. This was a cross-sectional study using baseline data from the Trial of Activity for Adolescent Girls. It included 1556 grade 6 girls who were randomly selected from 6 middle schools in each of the following 6 field site areas: Washington, DC, and Baltimore, Maryland; Columbia, South Carolina; Minneapolis, Minnesota; New Orleans, Louisiana; Tucson, Arizona; and San Diego, California. Girls wore accelerometers for 6 days to measure metabolic equivalent–weighted moderate-to-vigorous physical activity, a measure accounting for the volume and intensity of activity. Metabolic equivalent–weighted moderate-to-vigorous physical activity was calculated for the hours outside of school time using 2 different cutpoints, activity levels ≥3.0 metabolic equivalents and ≥4.6 metabolic equivalents, the latter indicating activity at the intensity of a brisk walk or higher. We mapped all of the parks within 1 mile of each girl's home. Trained staff used a checklist to document the presence of facilities and amenities at each park, including passive amenities, such as drinking fountains, restrooms, and areas with shade, as well as active amenities like basketball courts, multipurpose fields, playgrounds, and tennis courts.

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Key Words
adolescent health, physical fitness, environmental aspects, ecology, adolescent obesity

Abbreviations
TAAG—Trial of Activity for Adolescent Girls
MET—metabolic equivalent
MVPA—moderate-to-vigorous physical activity
MW-MVPA—metabolic equivalent–weighted moderate-to-vigorous physical activity
SES—socioeconomic status
MET-mins—mean minutes of metabolic equivalent–weighted moderate-to-vigorous physical activity

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RESULTS. Mean nonschool metabolic equivalent–weighted moderate/vigorous physical activity, using the 4.6 metabolic equivalent cutoff, was 611.1 minutes (range: 49.7–4718.6 metabolic equivalent minutes per 6 days) and 1704.8 metabolic equivalent minutes per 6 days (range: 276.2–5792.6 metabolic equivalent minutes per 6 days) when using the 3.0 metabolic equivalent cutpoint. Many girls had multiple parks within a 1-mile radius of their homes: 57% had ≥1 type of park, the majority being neighborhood or community parks; 42% had between 1 and 3 parks, 37% had ≥4 parks, and 14% had ≥8 parks. The type, number, and specific parks features were associated with girls' nonschool metabolic equivalent–weighted moderate/vigorous physical activity. At the 4.6 metabolic equivalent cutpoint, higher levels of nonschool metabolic equivalent–weighted moderate/vigorous physical activity were associated with both neighborhood and community parks (22 metabolic equivalent minutes) and miniparks (40 metabolic equivalent minutes). Each park, regardless of type, in the half-mile around each girl's home was associated with an increase in nonschool metabolic equivalent–weighted moderate/vigorous physical activity by 2.8% or 17.2 nonschool minutes of metabolic equivalent–weighted moderate/vigorous physical activity per 6 days. Beyond a half-mile, each park increased nonschool metabolic equivalent–weighted moderate/vigorous physical activity by 1.1% or 6.7 metabolic equivalent minutes per 6 days. For the average girl with 3.5 parks within a 1-mile radius of home, the presence of parks accounted for 36.5 extra nonschool metabolic equivalent minutes per 6 days, ~6% of total nonschool metabolic equivalent–weighted moderate/vigorous physical activity. Using the 3.0 metabolic equivalent cutpoint, this sums to an additional 68 metabolic equivalent minutes of nonschool metabolic equivalent–weighted moderate/vigorous physical activity over 6 days, or 4% of the total. The most common amenities in the parks were playgrounds, multipurpose fields, and picnic areas. Slightly more than one third of girls lived within a half-mile of a park with a basketball court, and >20% had access to walking paths and tennis courts in their local park. Higher levels of nonschool metabolic equivalent–weighted moderate/vigorous physical activity per 6 days were associated with walking paths (13 metabolic equivalent minutes), running tracks (82 metabolic equivalent minutes), playgrounds (28 metabolic equivalent minutes), and basketball courts (30 metabolic equivalent minutes). Parks with streetlights and floodlights were also associated with an increase of 18 and 22 minutes of nonschool metabolic equivalent–weighted moderate/vigorous physical activity, respectively. With the 3.0 metabolic equivalent cutoff for metabolic equivalent–weighted moderate/vigorous physical activity, additional nonschool metabolic equivalent minutes more than doubled when girls had miniparks (92 metabolic equivalent minutes), natural resource areas (36 metabolic equivalent minutes), walking paths (59 metabolic equivalent minutes), and running tracks (208 metabolic equivalent minutes) within a half-mile of their homes. Skateboard areas and special-use parks were negatively associated with nonschool metabolic equivalent–weighted moderate/vigorous physical activity in adolescent girls.

CONCLUSIONS. Adolescent girls who live near more parks, particularly near those with amenities that are conducive to walking and with active features, engage in more nonschool metabolic equivalent–weighted moderate/vigorous physical activity than those with fewer parks. Whether this is because of actual use of the parks or neighborhood choice could not be determined. Although the magnitude of the association between parks and additional minutes of metabolic equivalent–weighted moderate/vigorous physical activity was small for an individual, amounting to an average of 4%–6% of a girl's total nonschool metabolic equivalent–weighted moderate/vigorous physical activity, it is likely to have a large population-level association. Because of the potential population level impact, the use of parks to promote physical activity should be further studied.

PHYSICAL ACTIVITY IS an important predictor of morbidity and mortality and is considered one of the most important behaviors to promote good health.[1] Among US adolescents, it is of particular concern that physical activity levels are decreasing, and rates of obesity are increasing.[2,3] Physical activity may be constrained or facilitated by local environments.[4,5] Theoretically, where people live determines what they see, hear, and encounter on a daily basis. The availability of neighborhood facilities may be particularly relevant for youth, who are unable to drive and whose activity is often limited to the immediate distance that they are able to walk or bicycle. Access to parks is one of these key environmental factors that may impact physical activity levels. Several studies have shown that proximity to recreational facilities and parks is one of the most important predictors of physical activity.[6–8] Approximately 70% of adult respondents to a 1992 national survey indicated that they lived within walking distance of a park or playground.[9] However, the prevalence of living near a park or playground declined with decreasing income or education and increasing age. Those living in a mobile home or in a rural area were also less likely to report living near a park or playground.

If parks are abundant, people may be more physically active. But how important is it to have nearby parks and recreational facilities? Not all parks and park facilities may promote increased physical activity equally. Some parks are considered "active" in that they provide facilities and amenities for team sports, like soccer fields, baseball diamonds, or playground equipment, whereas others are considered "passive" parks that seem to promote sedentary activities and light physical activity by providing lawns, trees, landscaped gardens and shrubbery, lakes, fountains, picnic areas, and/or walking trails.[10] On a population level, it is not clear which of these features might be most conducive to physical activity.

Giles-Corti et al[8] studied 516 open public spaces >2 acres in size in Australia and found that their use among adults was associated with household proximity, size, and attractiveness and that better access was associated with a 50% higher likelihood of achieving high levels of walking. In a Los Angeles study, adults living within a 1-mile radius of parks reported more leisure exercise than those living beyond 1 mile of the parks.[11] Both of these studies, however, were limited to adults and did not separate out specific park features that may be associated with physical activity. To understand the relationship between physical activity and access to parks and park amenities among adolescent girls, we assessed all of the parks within a 1-mile radius of the homes of adolescent girls enrolled in the Trial of Activity for Adolescent Girls (TAAG).

METHODS

TAAG is a school-based, multicenter group-randomized trial designed to test an intervention to reduce the usual decline in moderate-to-vigorous physical activity among middle-school girls.[12] Six universities were awarded funds to establish field centers in the vicinities of Washington, DC, and Baltimore (University of Maryland); Columbia (University of South Carolina); Minneapolis (University of Minnesota); New Orleans (Tulane University); Tucson (University of Arizona); and San Diego (San Diego State University). The study was coordinated by the University of North Carolina and the National Heart, Lung, and Blood Institute Project Office. This study is an ancillary study to TAAG. All of the methods were approved by the institutional review boards of all participating institutions.

The sample size of 60 girls per school was selected to provide 90% power to detect an absolute difference in average metabolic equivalent (MET)-weighted minutes of moderate-to-vigorous physical activity (MVPA) of 10% at the end of the 2 years of the trial.[13] Each of the 6 sites obtained a complete roster of the sixth grade girls enrolled in each participating school in the winter of 2003. The coordinating center selected 60 girls at random from each school for invitation to the measurement of MVPA by accelerometry. Girls who were ineligible or who transferred out of the participating schools before the data were collected were replaced by other girls selected at random from the school rosters.[12]

Valid addresses were obtained for 1556 of the 1603 participating girls (97%) and were geocoded using ArcView (Environmental Systems Research Institute, Inc, Redlands, CA) software. We identified parks within a 1-mile radius of the girls' homes using local maps and information from local departments of recreation and parks. Trained staff documented the presence of facilities and amenities at each park including drinking fountains, restrooms, basketball courts, multipurpose fields, and tennis courts using a checklist. Tucson was an exception, because they already had a comprehensive database of local park facilities. We verified the data by visiting 10% of the parks. Only the presence of a facility or amenity was counted, not the number or condition. We classified each park using the definition of parks published by the National Recreation and Parks Association (Table 1).[10]

Physical Activity Measurement

The girls wore Actigraph accelerometers (Health Systems Model 7164; Manufacturing Technologies Inc, Shalimar, FL) for 6 consecutive days during the winter and spring of 2003. Readings ≥1500 counts per half-minute, or ~4.6 METs, were defined as MVPA; we reported previously that this threshold had the optimal sensitivity and specificity for discriminating brisk walking from less vigorous activities in grade 8 girls.[14] Half-minute counts were used instead of full-minute counts based on the expectation that they would be more sensitive to fluctuations in activity levels. Occasional missing accelerometer data within a girl's record were replaced via imputation based on the expectation maximization algorithm.[15] Counts ≥1500 per half minute were converted into METs using a regression equation developed for TAAG[14]; the METs were summed over the 5:00 AM to midnight day to provide MET-weighted MVPA (MW-MVPA), where 1 MET minute represents the metabolic equivalent of energy expended sitting at rest for 1 minute. Because activity levels associated with parks primarily occur outside of school hours, we examined total MW-MVPA during weekends and after 3:00 PM on weekdays, referred to as nonschool MW-MVPA.

A second analysis was performed using a lower cutpoint for defining MVPA, corresponding with 580 counts per half-minute (~3 METs) to capture slightly less intense levels of physical activity. This 3.0 MET definition for MVPA captures slow walking (2.5 mph), whereas the 4.6 MET definition capture activities that are at or above a brisk walk (3.5 mph).[16] We ran our analyses using both cutpoints.

Other Variables

Each school provided the percentage of grade 6 to 8 students on free or reduced-price lunches as a school level measure of socioeconomic status (SES). Generally, students whose families earn <200% of the poverty level were eligible for this program.

Neighborhood characteristics were derived for the area within a half-mile around each girl's home based on

TABLE 1 Types of Parks and Definitions

Park Type[10]	Definition	Description	Size
Minipark	Used to address limited, isolated, or unique recreational needs	Service area is usually <0.25-mile radius	2500 sq ft to 1 acre
Neighborhood park	Basic unit of the park system; serves as the recreational and social focus of the neighborhood; focus is on informal active and passive recreation.	Centrally located within its service area, usually 0.25- to 0.50-mile radius, uninterrupted by nonresidential roads and other physical barriers	5–10 acres
School park	Combines park with school site; similar to other classes of parks	Determined by location of school district property	Variable, depends on function
Community park	Serves broader purpose than neighborhood park; focus is on meeting community-based recreation needs, as well as preserving unique landscapes and open spaces	Determined by the quality and suitability of the site; usually serves ≥2 neighborhoods, service area between 0.5- to 3-mile radius	As needed to accommodate desired uses; usually between 30 and 50 acres
Large urban park	Serves broader purpose than community parks; used when community and neighborhood parks are not adequate to serve the needs of the community; focus is on meeting community-based recreational needs, as well as preserving unique landscapes and open spaces	Determined by the quality and suitability of the site; usually serves the entire community	As needed to accommodate desired uses; usually a minimum of 50–75 acres
Sports complex	Consolidates heavily programmed athletic fields and associated facilities to larger and fewer sites strategically located throughout the community	Strategically located community-wide facilities	Determined by project demand; usually a minimum of 25 acres, with 40–80 acres being optimal
Natural resource areas	Lands set aside for preservation of significant natural resources, remnant landscapes, open space, and visual aesthetics/buffering	Resource availability and opportunity	Variable
Special use	Covers a broad range of parks and recreation facilities oriented toward single-purpose use	Variable, dependent on specific use	Variable

the 2000 US Census Data. Neighborhood variables included the percentage of the population that was black, Hispanic, and white. Data were interpolated proportionally based on the census block group. Similarly, we created a neighborhood SES index in which we normalized 3 variables within sites and then summed them. We included the percentage of households in poverty, the percentage of individuals over 18 years with less than a high school education, and the percentage of unemployed individuals (Cronbach's $\alpha = .88$).

Because street networks often determine ease of getting from 1 destination to another, we also used 2 street design indices, a connectedness index and a street segment index.[17] All of the street network measures were based on the US Census Bureau's Topologically Integrated Geographic Encoding and Referencing/Line street centerline data. The connectedness index is defined as a combination of α, β, and γ indices, which are measures of the ratio of intersections to street segments. The α index is the ratio of the number of actual circuits or loops in the tract to the maximum possible number of circuits and is equal to: (number of links − number of nodes + 1)/2(number of nodes) − 5. The α index is always a number between 0 and 1, and a higher value indicates greater connectivity. β is the ratio of streets/nodes. Higher values indicate greater connectivity. The γ index is a ratio of the number of links (street segments) in the tract to the maximum possible number of links between nodes (intersections). The formula is: number of links/[3 × (number of nodes − 2)]. γ is also a number between 0 and 1, and a higher value indicates more connectivity. All of these measures are highly correlated with one another but do not always agree. Rather than select a single measure and lose the additional variability from the remaining 2, we combined the 3 measures into a single factor (Cronbach's $\alpha = .99$). The street segment index was defined by combining the average street length in feet, the average block size in acres, and the average block perimeter in miles. Again, these individual measures are highly correlated but do differ from one another. After normalizing each measure, we combined them into a single factor so each carried the same weight (Cronbach's α =.95).

Statistical Analyses

The data can be considered to have a hierarchical structure, in which girls (level 1 units) are nested within schools, and schools (level 2 units) are nested within a study site. Therefore, to determine whether proximity to parks was associated with nonschool MW-MVPA, school and site were treated as random effects in a hierarchical linear model. Factors that were treated as fixed effects were self-reported race/ethnicity, neighborhood racial makeup (percentage black and percentage Hispanic), SES, and street connectivity (defined by the half-mile radius around each girl's home) at the girl-level and the percentage of students who participated in the free or reduced lunch program at the school level.

Because the first-level residuals were not normally distributed, we log-transformed nonschool MW-MVPA. Consequently, our parameter estimates are expressed as percent changes in nonschool MW-MVPA for each unit change in our covariates. To make our explanations more easily understandable, we translated this percentage to a raw number representing the magnitude of this change for the "average girl" with the mean minutes of MW-MVPA (MET-mins). Although the trend between nonschool MW-MVPA and park density seemed to be linear and positive, we used both linear and nonlinear specifications for parks to explore the data. We also examined parks in different dimensions: the number of parks within a half-mile or 1 mile radius around the girls' address (called "buffer" models, which treated the number of parks linearly), as well as using gravity models that gave greater weight to closer parks and less weight to parks that are further away.[18] In general, the gravity measures were created using a formula of the following type:

$$P_w = \Sigma[f(d_{ij})]$$

where $f(d_{ij})$ is some function of distance between address i and park j. P_w is the sum of $f(d_{ij})$ over all of the addresses and parks. We tested 2 of these functions: a negative exponential decay and a Gaussian decay. The negative exponential decay function has the form $f(d_{ij}) = exp(-\beta d_{ij})$, and the Gaussian decay function has the form $f(d_{ij}) = exp(-d_{ij}^2/\beta)$. The 2 forms differ in the level of importance that distance has in determining the weights. The negative exponential form yields lower weights very quickly, whereas the Gaussian form looks more like half of the normal curve and does not drop as quickly for closer distances. In addition to the difference in the form of the function, β is a decay rate that dictates how much the weights drop as distance increases. We examined several different distances from home ranging from 0.25 miles to 10 miles, and for each we solved for the β that corresponded with a weight of 0.5 for a park at that distance. Because we only have detailed information on parks within 1 mile of girls' addresses, our weighted measures are essentially censored at the 1-mile distance. In addition to proximity and the number of parks, we examined the relationship between type of park and specific park features to physical activity.

RESULTS

The 1556 girls in our study were 45% white, 22% Hispanic, 21% black, 4% Asian, and 8% Native American or mixed race/ethnicity. On average, the neighborhoods within a half-mile radius of girls' homes are composed of residents who were 20% black (range: 0%–100%) and 6% Hispanic (range: 0%–52%), and 10% of households were below poverty level (range: 0%–43%). Average nonschool MW-MVPA using the 4.6 MET cutoff was 611.1 minutes (range: 49.7 to 4718.6 MET-mins/6 days). When using the cutpoint of 3 METS to define MW-MVPA, the mean was 1703.8 MET-mins/6 days,

TABLE 2 **Description of Variables**

Variable	Overall			
	Mean	SD	Minimum	Maximum
Total parks within 1 mile	3.5	3.77	0.00	22.00
Total parks within 0.5 miles	1.2	1.53	0.00	11.00
Total parks within 0.5–1 miles	2.3	2.66	0.00	16.00
Neighborhood/community parks within 0.5 miles	0.7	0.92	0.00	7.00
Neighborhood/community parks within 0.5–1 miles	1.3	1.56	0.00	10.00
Nonschool MVPA ≥3.0 METs (min per 6 d)	1703.8	657.62	276.16	5792.59
Nonschool MVPA ≥4.5 METs (min per 6 d)	611.1	409.79	49.74	4718.62
SES index	0.0	1.00	−3.60	1.32
Street connectedness index	0.0	2.97	−7.78	11.63
Street segment index	0.0	2.76	−2.92	33.17
Hispanic population in neighborhood, %	6	8	0.00	52
Black population in neighborhood, %	20	27	0.00	100
On free lunch (school level), %	37.1	26.44	0.00	91.00

with a range from 276.2 to 5792.6 MET-mins/6 days (Table 2).

There was considerable variation in access to parks by site. Figure 1 shows the average number of parks within a half-mile and 1-mile radius of each girl's home for each of the 6 sites. Within a half-mile radius, girls in Minneapolis had the highest average (2.2 parks), whereas girls in Tucson had the lowest average (0.34 parks, a sixfold difference).

When examining the importance of park proximity using the buffer model (Table 3), parks that were closer had a larger and significant effect on nonschool MW-MVPA compared with those that were farther away. Each park in the half-mile buffer was associated with an increase in nonschool MW-MVPA by 2.8% or 17.2 minutes per 6 days of nonschool MW-MVPA. Beyond a half-mile, each park increases nonschool MW-MVPA by 1.1%, or 6.7 MET-mins per 6 days, although the *P* value for this estimate was.09. For the 3.0-MET definition of MW-MVPA, the magnitude of effect is substantially greater: 33 MET-mins for each park within a half-mile, and 12 for each park between a half-mile and 1 mile. For the average girl with 3.53 parks within a 1-mile radius of home, this sums to an additional 68 MET-mins over 6 days.

Table 4 contains the results for gravity model accessibility measures. The linear specification for number of parks includes a count of the number of parks that are within the 1-mile buffer around each girl's address and translates to an increase of 10 minutes/6 days per park of nonschool MW-MVPA or 35 MET-mins per 6 days for the average girl in our study. This nearly doubles with the lower cutpoint for MW-MVPA. In contrast, the weighted measures were not significantly associated with nonschool MW-MVPA.

In addition to the presence of parks and their proximity, the type of park is associated with nonschool MW-MVPA (Table 4). Having either a neighborhood or community park within a half-mile of a girl's home was associated with 24.1 more MET-mins per 6 days. In the half-mile to 1-mile distance from home, neighborhood and community parks increases MW-MVPA by 3% or 18.6 MET-mins per 6 days. This effect was seen when community parks were analyzed with neighborhood parks but not separately. It also nearly doubled with the lower MW-MVPA cutpoint.

Many girls had multiple parks within a 1-mile radius of their homes: 42% had between 1 and 3 parks, 37% had ≥4 parks, and 14% had ≥8 parks. Having ≥4 parks within the 1-mile distance was associated with increased nonschool MW-MVPA. This analysis supports the linear association between parks and MW-MVPA. Table 5 indicates the wide variety of parks and park amenities within a half-mile of girls' homes, in order of their frequency. The majority of girls (57%) had ≥1 park within a half-mile radius of their homes. One third of the girls lived within a half-mile of ≥2 parks (data not shown). Nine percent had ≥3 parks within a half-mile radius, and another 9% had ≥4 parks within a half-mile. Most were either neighborhood parks (available to 27% of girls) or community parks (available to 23% of girls). Few girls lived in close proximity to large urban parks or sports complexes, but 17% lived close to a natural resources area, like a lake, beach, or forest.

The most common amenities in the parks were playgrounds, multipurpose fields, and picnic areas. Slightly more than one third of girls lived within a half-mile of a park with a basketball court, and >20% had access to walking paths and tennis courts in their local park.

Girls who lived near parks with playgrounds, basketball courts, multipurpose rooms (usually gymnasia), walking paths, swimming areas, and tracks had higher levels of nonschool MW-MVPA compared with girls who did not have these amenities within a half-mile. Parks with streetlights and floodlights were also associated with an increase of 18 and 22 minutes of nonschool MW-MVPA, respectively. There was a trend for increases in nonschool MW-MVPA if nearby parks had

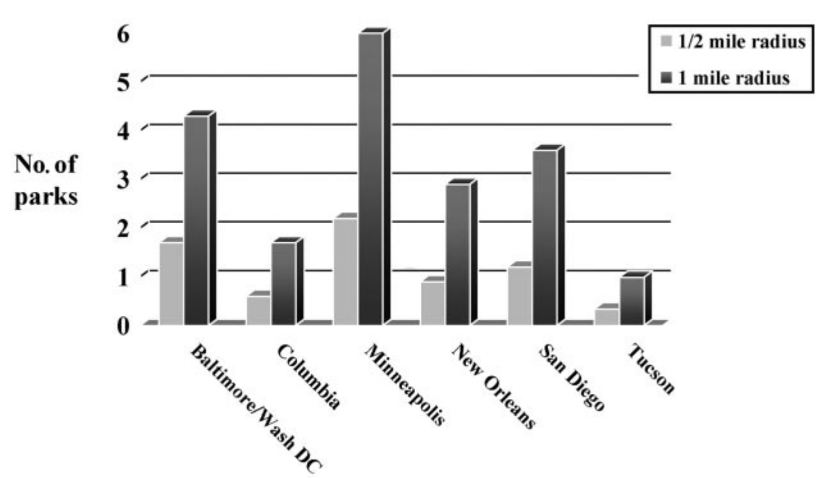

FIGURE 1
Average number of parks near girls homes by study center.

TABLE 3 Model Predicting MW-MVPA

Variable	Nonschool MVPA (≥4.6 METS)			Nonschool MVPA (≥3.0 METS)		
	Coefficient Estimate	Estimated Magnitude (minimum per 6 d)	P	Coefficient Estimate	Estimated Magnitude (minimum per 6 d)	P
Intercept	6.31		<.0001	7.37		<.0001
Parks within 0.5 miles	0.03	17.2	.04	0.02	33.4	.005
Parks within 0.5–1 miles	0.01	6.7	.09	0.01	12.0	.009
SES index	−0.05	−27.6	.1	−0.03	−5.0	.15
Street connectedness index	−0.01	−3.3	.49	−0.12	−6.9	.27
Street segment index	0.00	0.15	.96	−0.58	2.5	.53
Hispanic population, %	−0.83	−344.7	<.0001	0.00	−198.1	.0009
Black population, %	−0.24	−128.7	.007	0.00	−753.0	.0002
On free lunch (school level), %	0.00	0.59	.42	0.00	2.5	.06
Girls race/ethnicity (individual level; white is reference group)						
Asian	−0.40	−199	.0003	−0.22	−340.2	<.0001
Black	−0.08	−44	.17	−0.04	−67.0	.17
Hispanic	−0.13	−72.4	.005	−0.07	−117.5	.006
Multiracial	−0.10	−58.3	.2	−0.04	−60.3	.47
Native American	0.22	156	.07	0.13	236.6	.05

TABLE 4 Coefficients and Magnitude of Association From Other Models Predicting MW-MVPA

Linear Model	MVPA (≥4.6 METS)		MVPA (≥3.0+ METS)	
	Coefficient Estimate[a]	Estimated Magnitude (minimum per 6 d)	Coefficient Estimate[a]	Estimated Magnitude (minimum per 6 d)
Total parks within 1 mile (per park)	0.02[b]	9.97	0.01[b]	18.80
Gravity models				
Negative exponential weighted total parks	0	0.3	0	−0.02
Gaussian weighted total parks	0	0.28	0	−0.03
Type of park in buffers				
Neighborhood and community parks within 0.5 miles	0.04[b]	24.15	0.03[b]	45.48
Neighborhood and community parks within 0.5–1 miles	0.03[b]	18.58	0.02[b]	29.60

[a] Based on model controlling for SES index, neighborhood race/ethnicity, street connectedness index, percentage of children on free lunch, and girl race/ethnicity.
[b] Significant at the .05 level.

shaded areas and drinking fountains. In contrast, girls living near parks with skateboard facilities had fewer MET-mins, and there was a trend for lower MET-mins if there were amenities for lawn games (eg, horseshoes). The average change in minutes of nonschool MW-MVPA associated with park amenities increased substantially with the 3.0 MET cutoff. The most dramatic changes were seen in areas that are conducive to walking: miniparks, natural resource areas, walking paths, and tracks where additional nonschool MET-mins more than doubled.

DISCUSSION

Our study shows that the presence of parks was associated with higher levels of nonschool MW-MVPA among adolescent girls and that this relationship holds for proximity, number, and the type of parks, as well as specific park amenities. The magnitude of the association of nonschool MW-MVPA with parks in 1 mile is statistically significant but remains a small portion, an average of 4%–6% of the total nonschool MW-MVPA for our sample, based on the 3.0 and 4.0 MET cutoffs, respectively.

The study has several limitations. It is cross-sectional and is, therefore, subject to issues of endogeneity. It is possible that families who are active choose to live near parks. However, our data did not allow us to specifically connect the girl's physical activity to a particular location, so it is possible that parks are not directly associated with their physical activity. It is plausible, however, that the very presence of parks increases the exposure to physical activity, making it a more normative behavior.

Neighborhood and community parks had many features in common, including playgrounds, basketball courts, and multipurpose fields. Many park features were associated with physical activity, but because these features were common to many types of parks, we were not able to say precisely whether one feature is more important than another. The finding that parks with active amenities are associated with greater levels of nonschool MW-MVPA than parks without those amenities suggests that for adolescent girls, access to active parks may be important. However, the positive association between nonschool MW-MVPA with swim areas cannot be related to girls using these particular facilities,

TABLE 5 **Accessibility of Park Features and Associated Minutes of Nonschool MW-MVPA**

Variable	Girls With ≥1 Park Within 0.5 Miles, %	Parks Within 0.5 Miles, *n* (%)	Estimated MW-MVPA (≥4.6 METS), min	Estimated MW-MVPA (≥3.0 METS), min
Any park	57	505 (100)	20[a]	38[a]
Neighborhood park/community park	44	263 (52)	22[a]	42[a]
Neighborhood park	27	161 (32)	NS	NS
Community park	23	102 (20)	NS	NS
Natural resource	17	90 (18)	NS	36[a]
Minipark	12	71 (14)	40[b]	92[a]
Special use	8	40 (8)	−34[a]	−77[a]
Sports complex	7	21 (4)	NS	NS
Large urban park	5	20 (4)	NS	NS
Any amenity	55	428 (86)	NS	NS
Playgrounds	48	325 (64)	28[a]	39[a]
Multipurpose field	42	256 (51)	NS	NS
Picnic areas	43	285 (56)	NS	NS
Restrooms	41	239 (47)	NS	NS
Shaded areas	40	216 (43)	14[b]	20[b]
Drinking fountains	39	213 (42)	14[b]	24[a]
Streetlights	37	236 (47)	18[a]	28[a]
Basketball courts	35	201 (40)	30[a]	37[b]
Floodlights	30	148 (29)	22[a]	NS
Multipurpose room(s)	22	115 (23)	13[a]	13[a]
Walking path	22	203 (40)	13[a]	59[a]
Tennis courts	21	121 (24)	NS	NS
Park offices	17	53 (11)	NS	14[b]
Park is fenced	15	70 (14)	NS	NS
Swimming area	9	35 (7)	32[a]	NS
Volleyball	9	43 (9)	NS	NS
Ice rink	9	35 (7)	NS	28[b]
Lawn games	4	20 (4)	−55[b]	−161[a]
Amphitheater	4	9 (2)	NS	16[b]
Archery	4	5 (1)	NS	NS
Handball	4	25 (5)	NS	NS
Running track	3	7 (1)	+82[a]	+208[a]
Skateboard area	3	8 (2)	−48[a]	−94[a]

Based on model controlling for SES index, neighborhood race/ethnicity, street connectedness index, percentage of children on free lunch, and girl race/ethnicity. NS indicates not significant.
[a] $P < .05$.
[b] $P < .10$.

because they were instructed to remove the accelerometers to swim. It may be that the higher levels of physical activity were related to getting to the park, rather than using any particular facilities there. As has been shown in several studies of adults, proximity to parks is an important predictor of physical activity.[6,7] Adults commonly walk to parks, but once there they are often sedentary.[11] The finding of associations between PA and park proximity was strongest up to a half-mile and diminished significantly for parks that were farther away is consistent with the 2001 National Household Transportation Survey finding of the average walking trip being 0.5 miles with the median distance of 0.4 miles for girls ages 12 to 14.[19] If girls were to walk to parks, it is unlikely that they would visit parks greater than the half-mile distance. The lack of findings between parks and proximity using the weighted models may be because of not accounting for features such as esthetics and the presence of organized activities, which suggests that a distant park with desired amenities should have higher weight than a closer one. In addition, we only had data on parks within a 1-mile buffer around girls' homes. Perhaps parks outside this buffer are important, especially if adolescents are driven to the destinations. Future studies could be more comprehensive, examining a wider age group, as well as parks within a larger radius.

The negative association between girls' nonschool MW-MVPA and skateboarding facilities and special-use parks (predominantly golf courses and driving ranges) implies that girls may have avoided these spaces. Under conditions of limited resources and available space/land, building facilities that target very specific population groups may supplant facilities that could serve other populations.

The relative magnitude of the association between parks and nonschool MW-MVPA for the average adolescent girl seems small when using either cutpoint compared with the total minutes of nonschool MW-MVPA; however, at a population level, a difference of a few percentage points can be significant for population health.[20] Observations of neighborhood park users in Los Angeles, CA, indicate that the number of males using parks greatly exceeds the number of females by as much as 40%.[11] Indeed, males were also observed to be twice as likely as females to be engaged in vigorous activity in neighborhood parks.[21] It is likely the association between parks and physical activity may be higher for males than we have seen for females.

Our findings indicate that the presence of parks is associated with physical activity. Although the potential impact may be small for an individual, it is likely to be large for a population.[20] Future studies should examine the importance of parks to other age groups and for males and also include objective measures, such as using observation or geographic positioning system tracking devices, to confirm how often and for what duration parks are actually used by participants.

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