ORIGINAL ARTICLE

The Perceived and Built Environment Surrounding Urban Schools and Physical Activity Among Adolescent Girls

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Abstract

Background Neighborhood perceived/built environment and physical activity (PA) associations have been examined for adolescents around homes, but not surrounding schools.
Purpose The purpose of this paper is to examine if positive perceptions/built environment in neighborhoods surrounding schools predict PA among low-income, urban adolescent girls.
Methods Measures include: minutes in moderate-vigorous PA (MVPA, ankle accelerometry), perceptions of the school environment (questionnaire), built environment (neighborhood audit). Analyses include multi-level models.
Results Two hundred twenty-four sixth and seventh grade girls [mean(sd) age=12.1(0.7)years] from 12 schools serving low-income, primarily African American communities; mean MVPA 35.4 min (mean days assessed=5.8). Girls in schools with more positive perceptions of the neighborhood environment surrounding the school were less active (β= 7.2, p=0.043). Having "places to go within walking distance" (perceptions) and number of food stores near school (built environment) positively relate to MVPA (β=5.5, p= 0.042 and β=0.59, p=0.047).
Conclusions Among neighborhoods surrounding urban schools, positive perceptions do not predict PA; accessibility, via both perceived and built environment, support PA.

Keywords Adolescent girls · Physical activity · Built environment · African American · Schools

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Background

African American adolescent girls continue to be disproportionately affected by the obesity epidemic [1]. Between 1999 and 2010, African American adolescent girls were 47 % more likely to be obese compared to Caucasian girls [1]. Additionally low-income children are 3.4 times more likely to be overweight or obese compared to high income children [2]. Low-income African American adolescent girls are also less likely to be physically active compared to higher income or Caucasian girls [3–9]. Although recent evidence suggests that the racial disparities in physical activity among adolescent females may be shrinking [10], the socio-economic disparities have remained consistent. One factor that may contribute to the obesity and physical activity disparities observed among adolescent girls is the neighborhood environment in which they live or go to school.

The built environment, including all aspects of the surroundings, both natural and man-made, may influence the risk for obesity by creating a climate that supports physical inactivity and unhealthy eating [11]. Two reviews were recently published that investigate the influence of the built environment on the health of children, one focusing on obesity (n=48 papers published between 2008 and 2009) [12] and one focusing on physical activity (n=103 papers published before January 2010) [13]. Both review articles found that access to playgrounds and recreational facilities was associated with increased activity and reduced obesity. The review that focused on the built environment and childhood obesity found that the distance between the home and fast-food restaurants, density of fast-food restaurants, and presence of convenience stores were associated with increased risk for obesity [12]. In contrast, the review of the built environment and physical activity found that a mix of land uses (residential and non-residential, including commercial establishments) was associated with increased

activity [13]. Most studies of the built environment use the home as the central unit, not the school.

The Ecological Model of Active Living was developed to identify potential environmental and policy influences on physical activity specific to four domains of active living: household activities, occupational activities, active recreation, and active transport [14]. This model suggests that there are multiple levels of influence for each domain, including intra-personal factors, the perceived environment, the built environment, and policies. In this model, both the perceived environment, including constructs such as safety, attractiveness, comfort, accessibility, and convenience, and the built environment, including access and characteristics, influence physical activity [14].

Positive perceptions of the neighborhood environment are thought to increase the likelihood of being physical active among youth by increasing active commuting and outdoor play [15]. Perceptions of the home neighborhood environment have been associated with objectively measured physical activity and active commuting among adolescent girls, including accessibility (i.e.: access to physical activity facilities, bicycle/walking trails) and safety [15, 16]. A recent study found that adolescent girls' perceptions of children not playing outdoors in their neighborhood were associated with a decline in physical activity over 2 years [17]. Other factors associated with a decline in physical activity among this mixed-income sample included having well-lit streets and access to walking/biking trails, both opposite of the hypothesized direction, leading the authors to recommend further work in this area. Focusing on the environment surrounding schools, instead of the home environment, could have far-reaching policy implications because law makers often have the ability to enact zoning laws and regulations in the neighborhoods surrounding public schools.

This study focuses on a sample of predominantly African American adolescent girls attending schools serving low-income, urban neighborhoods. The objective was to examine the relationship between adolescent girls' perceptions of the physical environment surrounding their schools, the characteristics of the built environment surrounding their schools, and their objectively measured physical activity. There were three hypotheses based on the Ecological Model of Active Living: (1) adolescent girls with a positive perception of the environment surrounding their school are more active than girls with a less positive perception; (2) adolescent girls attending schools surrounded by neighborhoods with health promoting characteristics (accessibility and aesthetics) are more active than girls attending schools in neighborhoods with fewer health promoting characteristics; (3) positive perceptions of the environment surrounding the school are associated with higher physical activity, controlling for health promoting characteristics of the built environment.

Methods

Participants and Design

This study was conducted using baseline measures from a multi-level randomized controlled trial of health promotion/obesity prevention conducted among sixth and seventh grade girls attending schools in a large urban school district serving primarily low-income communities. The trial, "Challenge in Schools", is based on Developmental Ecological Theory [18, 19] and targets sixth and seventh grade girls in small groups during the lunch period and after school using the curriculum from an evidence-based obesity prevention program [20] in combination with changes to the school nutrition, physical activity, and social environments. Data were collected during the fall semester of the 2009 and 2010 school years.

School inclusion criteria were: (1) >75 % of students eligible for free/reduced priced lunch; (2) >70 % of students African American. The sample included six middle schools (grades 6–8) and six K-8 schools (kindergarten to grade 8) in an urban public school system. Each school had a separate catchment area with no overlap. Adolescent girls in grade 6 or 7 with no chronic illness or health condition that would interfere with participation in a physical education class were recruited to participate through mailings or in-person during lunch shifts and at school-sponsored events. Informed consent was obtained from the primary caregiver and informed assent was obtained from all participants prior to the start of the study. This study was approved by Institutional Review Boards at both the University and the Public School System where the study took place.

Within the 12 schools selected to participate, 425 sixth and seventh grade girls were recruited and evaluated (mean recruitment rate 44 %). Of the sample of 425, 290 were randomized to receive an accelerometer, and 82.4 % of these had valid accelerometry data (n=239, defined below). An additional 15 did not complete the perceptions of the neighborhood environment around the school questionnaire, leading to a final sample size of 224 (52.1 % of the original sample, described in Table 1). An inclusion/exclusion analysis revealed no difference in age, overweight/obese status, physical activity, or mean perceptions of the environment among the included versus the excluded participants.

Procedures

At baseline, adolescents completed a two-part, after school assessment (~60 min each) occurring >7 days apart. All questionnaires were administered using audio enhanced computer-assisted software. All questionnaires included in this manuscript were administered on day 1. Accelerometers were given on day 1 and collected on day 2.

Table 1 Sample description of urban adolescent girls (n=224)

	% or Mean	Range	Standard deviation
% 6th grade	55.4 %	–	–
Age (years)	12.1	10.1–14.4	0.7
% Black or African American	84.2 %	–	–
% Overweight or obese	44.6 %	–	–
BMI-for-age z score	0.96	−1.4-2.9	1.0
Days of accelerometer data	5.8	2-7	1.1
MVPA (min/day)	35.4	0-104.5	18.8
% Meeting recommended 60 min/day MVPA	11.6 %	–	–
% Walk to or from school	36.7 %	–	–
Distance to school (miles)	1.9	0.03–9.0	1.8
% currently enrolled in Physical Education class	50.9 %	–	–

BMI body mass index; *MVPA* moderate to vigorous physical activity

Measures

Demographics

Adolescents reported race/ethnicity, date of birth (to calculate chronological age), mode of transportation to/from school, and whether they were currently enrolled in a physical education class.

The mean age of the girls was 12.1 years, and the majority were self-identified as Black or African American (Table 1). Nearly one third walked either to or from school, and the mean distance from home to school (based on home address given by the participant's primary caregiver) was 1.9 miles. Half of the participants reported current enrollment in physical education.

Physical Activity

A subset of girls was randomly selected to wear an Actical accelerometer (Philips Respironics, Minimitter, Bend, OR) on their non-dominant ankle, attached using a reinforced medical band at school, on a weekday. Participants were instructed not to remove the band while in their care. Data collection staff returned to the school >7 days after placing the band to remove it. Activity counts were collected in 1-min intervals.

Accelerometer data were reduced using software provided by the manufacturer (Actiware 9.0). Only days with complete data (i.e., full 24-h period) were included in the analysis. After removing the first and last days of data, up to 7 full days of physical activity data (24-h periods) were retained [21]. Days with a daily average of <60 counts were treated as incomplete and removed from the analysis. A "valid day" of data contains 24 full hours of data (sleep and wake times included) with ≥60 a daily average activity counts per minute. In a laboratory-based study, compared to MET values measured using indirect calorimetry, ankle accelerometry was validated ($r=0.91$, $p<0.001$) and

thresholds for sedentary (≤1.5 METS), light (1.5–3.0 METS), and MVPA (>3.1 METS) were established and found to be sensitive (91 %) and specific (84 %, ROC area under curve=0.91; 95%CI, 0.87–0.95). The threshold for minutes in MVPA (3,200 counts/min) established in this study were applied to this data.

Mean number of days with accelerometer data was 5.8 (Table 1). On average, the girls spent 35.4 min/day in MVPA, with 11.6 % meeting the current recommendation of engaging in 60 min/day of MVPA [22].

Overweight/Obesity

Body mass index (BMI) was calculated from weight and height, measured by trained staff using standardized procedures (measured twice; if weight differs at all/if height differs by 2 cm, a third measure was taken; the two closest measures were averaged). Weight was measured in kilograms to the nearest tenth using standard scales (TANITA 300GS, Tanita Corp., Tokyo, Japan). Height was measured by a portable stadiometer (Shorr Productions, Olney, MD), in centimeters to the nearest tenth. BMI-for-age percentiles and z scores were based on gender-specific CDC 2000 growth standards [23, 24]. Weight status was defined as BMI-for-age ≥85th and <95th percentile designated "overweight" and ≥95th percentile designated as "obese" [25].

Nearly half of the participants were overweight or obese (Table 1), with a BMI-for-age z score ranging from −1.4 to 2.9.

Perceptions of the Neighborhood Environment around the School

Perceptions of the neighborhood environment surrounding schools were assessed using a modified version of a 10-item neighborhood environment questionnaire developed to assess perceptions of the environment surrounding the home among adolescent girls [26]. Response items were on a five-

point Likert scale (disagree a lot, disagree a little, neither agree or disagree, agree a little, or agree a lot). The 2-week test–retest reliability for individual items on this scale ranged from 0.37–0.58 (weighted kappa) coefficients [26]. The measure was adapted by changing the term "near your home" to "near your school". This measure assesses safety, aesthetics, and accessibility.

This questionnaire was analyzed by examining each of the 10 items individually (as has been done in previous studies [15–17]). Items were examined with the original five-point Likert scale and by collapsing items into a three-point scale (disagree a little or a lot, neither agree or disagree, agree a little or a lot) [15, 16].

To identify items that comprise a unified scale, a factor analysis was conducted. The original 10 items (five-point Likert scale) were entered into a principal components analysis with a varimax rotation and eigenvalue set at one. Item retention was based on both primary and secondary factor loadings. Items were retained in the factor model if they had primary factor loadings ≥0.40 and secondary factor loadings ≤0.30. The latter criterion was used to clarify item loadings across factors. Items that loaded on two factors but had a specific value on one factor that was at least twice as high as the value on another factor were retained. Items were removed one at a time. That is, after each factor analysis was run, the least adequate item was removed. Subsequent factor analyses were conducted until the cleanest solution was attained.

Factor analysis was based on a sample of 392 adolescent girls that completed the perceptions of the neighborhood environment around the school questionnaire and. The factor analysis yielded a seven-item solution representing one unified scale. The initial factor loadings are shown in Table 2. The internal consistency (Cronbach's alpha) of the seven-item scale was 0.68. A mean of the seven items was used to generate the seven-item "mean perceptions of the neighborhood environment" scale (mean=3.5, standard deviation=0.7).

Schools were divided into those surrounded by "high positive perception" neighborhoods and "low positive perception" neighborhoods using a median split of the mean perceptions of the neighborhood environment scale (median=3.57). Although converting a continuous variable into a categorical variable results in a loss of information, in this case it is more theoretically meaningful to describe perceptions of neighborhoods as higher (more positive) versus lower (less positive). Range of individual scores for "high positive perception" neighborhoods was 3.70–3.90 (six schools, n=89, 39.7 %) and for "low positive perception" neighborhoods was 3.18–3.44 (six schools, n=135, 60.3 %).

Neighborhood Built Environment

To assess the built environment surrounding urban middle schools, a modified version of the Active Neighborhood Checklist was employed [27]. The Active Neighborhood Checklist was developed from the St. Louis Audit Tool [28] as a short, objective tool for measuring the built environment [27]. Auditors attending two half-day trainings: one in-office training and one training in the field to ensure reliability between auditors. The audits were conducted in a car with a driver and auditor. The auditors surveyed 16 segments (1/4 × 1/4 mile each) per school, extending 1/2 mile from the school in a 4×4 grid pattern. The constructs in the analysis included density of food outlets (total number of fast-food/other restaurants, convenience/corner stores, grocery/supermarkets, food carts, coffee shops, etc.), density of fitness facilities (walking/biking trails, basketball/volleyball/tennis courts, baseball/soccer fields, playgrounds, outdoor pools, indoor fitness facilities, recreation centers, etc.), and presence of aesthetic features (including graffiti, broken windows, abandoned buildings) per segment per school. Data from the most proximal segments, extending 1/4 mile from the school, were used in this analysis.

Table 2 Initial factor loadings and response prevalence: perceptions of the neighborhood environment around the school questionnaire

	% Agree[b]	1	2	3
10. The streets near my school are well lit at night	37.9	0.670	0.024	−0.090
5. Walkers and bikers on the streets near my school can easily be seen by people in their homes	52.2	0.630	−0.048	−0.013
9. There are many interesting things to look at while walking near my school	48.2	0.624	−0.207	0.131
4. It is safe to walk or jog near my school	43.8	0.622	0.399	0.072
8. I often see other girls or boys playing outside around my school	73.7	0.536	−0.277	−0.506
3. There are bicycle or walking trails near my school	42.4	0.519	0.069	0.229
2. There are sidewalks on most streets near my school	86.2	0.468	0.107	0.121
6. There is so much traffic that it makes it hard to walk near my school[a]	25.9	−0.122	0.753	0.000
7. There is a lot of crime near my school[a]	21.9	0.157	0.734	−0.041
1. There are many places I can go within walking distance of my school	47.3	0.284	−0.137	0.829

[a] Reverse coded for factor analysis

[b] Agree a little or agree a lot

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Analysis Plan

Data were analyzed using SPSS 20.0 [29]. Bivariate analyses were conducted to identify potential covariates, including Spearman correlations and t-tests. Significance was set at $\alpha=0.05$. Multi-level models were employed to examine the relationship between physical activity and the perceptions of the environment, with minutes in MVPA as the dependent variable (DV), school entered as a random, level 1 effect, and perceptions of the environment (independent variable, IV) and individual-level covariates entered as fixed effects in the model. Multi-level models were also used to examine the relationship between physical activity and the built environment in a similar manner, with built environment characteristics entered as fixed effects in the model.

The DV was examined using the Shapiro–Wilk test for normality, and skewed values were normalized by taking the square root. All regression analyses were run with both the normal and non-normal DV and if significance remained, findings from the non-normally distributed DV were presented for ease of interpretation.

Results

Relationship Between Perceived Neighborhood Environment Surrounding the School and Physical Activity

Bivariate analyses of individual-level variables demonstrated that older girls were more active than younger girls ($r=0.17$, $p=0.013$) and girls who were overweight or obese engaged in 6.5 fewer minutes of MVPA per day on average ($t=2.7$, $p=0.008$) versus girls who were a healthy weight. Neither participation in physical education class nor walking to/from school was associated with minutes per day in MVPA. Girls who were older and lived further from their school had a more negative perception of the neighborhood surrounding the school and were more likely to attend the schools surrounded by "low positive perception" neighborhoods based on both the mean perceptions of the neighborhood environment scale ($r=-0.15$, $p=0.023$ and $r=-0.14$, $p=0.042$ respectively) and the binary variable based on the median split, ($t=3.50$, $p=0.001$ and $t=3.51$, $p<0.001$, respectively).

The intra-class correlation within schools of minutes/day in MVPA was 0.023, indicating clustering of MVPA within schools and supporting the need to employ multi-level modeling. In a multi-level model (random effect=school; fixed effects=age, overweight/obese status, distance from home to school, and number of days wearing accelerometer), the mean perceptions of the neighborhood environment scale was not associated with minutes in MVPA ($\beta=1.52$, $p=0.370$).

In the analysis of the 10 items individually from the perceptions of the neighborhood environment around the

school questionnaire, only the first item was associated with minutes in MVPA in a multi-level model ($\beta=5.5$, $p=0.042$), such that participants who agreed a little or a lot with the statement "There are many places I can go within walking distance of my school" engaged in an average of 5.5 min of MVPA more than participants who were neutral or disagreed with this statement. This item was not included in the seven-item mean perceptions of the neighborhood environment scale based on the factor analysis.

In a final multi-level model using the same random and fixed effects described above, the variable separating schools into those surrounded by "low positive perception" and "high positive perception" neighborhoods was associated with minutes in MVPA ($\beta=7.2$, $p=0.043$), such that students in schools with an overall higher perception of the environment surrounding the school were engaging in 7.2 fewer minutes in MVPA on average.

Relationship between Built Environment and Physical Activity

A description of the built environment extending 1/4 mile from the schools is included in Table 3. This description includes the overall scores from the Active Neighborhood checklist and a comparison of schools surrounded by "low positive perception" and "high positive perception" neighborhoods. As shown in Table 3, schools with an overall lower positive perception of the neighborhood surrounding neighborhood had a greater number of segments with graffiti or broken windows (2.5 versus 1.0 1/4 × 1/4 mile segments surrounding the school out of 4) and abandoned homes and buildings (2.0 versus 0.5 segments out of 4). These "low positive perception" neighborhoods also had a greater number of food outlets and fewer fitness facilities surrounding the school compared to "high positive perception" neighborhoods (6.8 versus 3.3 food outlets; 4.0 versus 4.4 fitness facilities). When examining the association between these built environment features and individual-level factors (Table 3), the presence of graffiti or broken windows and the presence of abandoned homes and buildings were inversely associated with individual girls' perceptions of the environment ($r=-0.21$, $p=0.002$ and $r=-0.018$, $p=0.008$, respectively), yet positively associated with minutes per day engaging in MVPA ($r=0.15$, $p=0.026$ and $r=0.14$, $p=0.035$, respectively). Additionally, a greater number of food outlets and fitness facilities in the neighborhood were both associated with a greater number of minutes per day engaging in MVPA ($r=0.20$, $p=0.002$ and $r=0.16$, $p=0.018$).

When including each neighborhood level factor listed in Table 3 as a fixed effect in separate multi-level models (random effect=school; fixed effects=teen age, overweight/obese status, distance from home to school, and number of days wearing accelerometer), the only factor

Table 3 Built environment within 1/4 mile of schools (*n*=12) measured by neighborhood audit

	Mean (range)			Correlation *r* (*p*)	
	Total (*n*=12)	"Low positive" perception neighborhoods (*n*=6)	"High positive" perception neighborhoods (*n*=6)	Perception score	Minutes in MVPA
Graffiti or broken windows[a]	1.8 (0–4)	2.5 (0–4)	1.0 (0–3)	−0.21 (0.002)	0.15 (0.026)
Abandoned homes or buildings[a]	1.3 (0–4)	2.0 (0–4)	0.5 (0–1)	−0.18 (0.008)	0.14 (0.035)
Number of food outlets[b]	5.1 (0–17)	6.8 (0–17)	3.3 (0–9)	ns	0.20 (0.002)
Number of fitness facilities[c]	4.4 (1–10)	4.0 (1–10)	4.8 (2–8)	0.15 (0.029)	0.16 (0.018)

MVPA moderate to vigorous physical activity

[a] Number of segments out of four

[b] Total number of fast-food/other restaurants, convenience/corner stores, grocery/supermarkets, food carts, coffee shops, etc. in the four segments

[c] Total number of walking/biking trails, basketball/volleyball/tennis courts, baseball/soccer fields, playgrounds, outdoor pools, indoor fitness facilities, recreation centers, etc. in the four segments

listed in Table 3 associated with minutes in MVPA was number of food outlets (*β*=0.59, *p*=0.047), such that for every one additional food store near a school, girls engage in nearly a minute more MVPA.

Relationship Between Perceived Neighborhood Environment Surrounding the School and Physical Activity Adjusting for the Built Environment

Both perceived and built environment factors were included in a single multi-level regression model to determine if each factor is independently associated with MVPA when controlling for the other. When both the individual item, "There are many places I can go within walking distance of my school" (perceived) and number of food outlets near the school (built) were included together in the model, neither item was associated with minutes in MVPA (*β*=5.2, *p*=0.066 and *β*=0.54, *p*= 0.066, respectively).

When including both the variable separating schools into "low positive perception" and "high positive perception" neighborhoods (perceived) and number of food outlets near the school (built) in the same model, each of these variables was significantly associated with minutes in MVPA (Table 4).

Discussion

There were two main findings from this study. First, girls attending schools with more positive perceptions of the physical environment around their school were significantly less active compared to girls with lower positive perceptions. The direction of this finding did not support our hypothesis. After examining the differences in the built environment between the low and high positive perception neighborhoods, we noted that the neighborhoods around schools with lower perception scores had a greater number of non-aesthetically pleasing features, such as graffiti, broken windows, or abandoned homes. These features were also associated with greater activity; however the strength of this association was low.

This finding suggests that features that may support a negative perception of the environment in other populations, leading to a lower likelihood of being physically active [13], may not be a deterrent to activity among low-income, urban adolescent girls. This could be due to a ubiquitous distribution of abandoned homes and broken windows in many low-income, urban neighborhoods [30, 31] that may lead to a normative negative aesthetic that does not deter residents from being active. Also, although only schools serving low-income families were selected to participate in this study, there could

Table 4 Multi-level model of minutes in moderate to vigorous physical activity, including perceived and built environment measures

	β	*p* value	95 % confidence interval
Low positive perception neighborhood (versus high)	6.06	0.025	0.78, 11.34
Number of food outlets within 1/4 mile of the school	0.47	0.024	0.06, 0.88
Teen age (years)	2.81	0.107	−0.61, 6.23
Overweight/obese (versus normal weight)	−5.74	0.021	−10.59, −0.88
Distance from home to school (miles)	0.49	0.503	−0.95, 1.93
Number of days with accelerometer data	0.07	0.947	−2.1, 2.2

School included as random intercept

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be a meaningful distribution of poverty within these low-income communities that impacts activity. For example, some families may need to rely on active transportation to and from school, food stores, etc. because they do not have access to a vehicle or money for public transportation.

Our second main finding was that both perceptions of having "places to go" within walking distance of the school and measured number of food stores/fitness facilities were positively related to physical activity. This finding supports our hypothesis and previous studies suggesting that the construct of "accessibility", the presence of a diverse mixture of commercial destinations, is an important factor predicting physical activity in urban populations [32–36]. This interpretation is also in line with our conceptual framework, likely working through both the domains of active recreation and active transport. If adolescent girls have places in the neighborhood surrounding their schools where they can walk (active transport) and play (active recreation), they are likely to engage in a greater amount of MVPA.

There are strengths and limitations to this study. One of the primary strengths is also one of the primary limitations—the population targeted in this investigation. It is important to focus studies on low-income, urban, predominantly African American adolescent girls, because this is a population at increased risk for obesity and inactivity. However, by focusing on such a specific population, findings are not generalizable to other populations or geographic areas. Other strengths of this study include the use of a combination of methods to evaluate the environment (both perceptions and an audit tool). It should be noted, however, that perceptions are inherently subjective and such questions may be interpreted differently for different girls. Also, the use of the audit tool allowed the identification of aesthetic features of the buildings and roads (i.e., broken windows and graffiti) that would be missed when employing a mapping approach. Other limitations included data not used in this analysis, such as parental perceptions of the environment and neighborhood level statistics including poverty. Neighborhood crime data was also not examined, perceived nor real. Studies examining the impact of crime on the relationship between the built environment and health have yielded mixed findings [13, 37, 38].

The use of an objective measure of physical activity was a strength; however, accelerometry does not provide information on the type of activity. Contextual data provides a more comprehensive understanding of specific types of physical activity behaviors. In addition, comparison of accelerometer data across studies is often difficult due to differing methods including the device, placement, wear time, measurement increment, and thresholds.

In conclusion, this study found that the relationship between either neighborhood perceptions or neighborhood aesthetics (built) and physical activity were the inverse of the hypothesized direction, suggesting that perceptions and aesthetics are related to physical activity in a different manner in a low-income, urban population of adolescent girls compared to previous studies of other populations. Additionally, in the neighborhoods surrounding urban public schools serving predominantly low-income families, neighborhood accessibility, both perceived and measured, was associated with higher levels of physical activity among adolescent girls.

Examining the role of the built environment in individual health behaviors, including physical activity and healthy eating, is an emerging area of research that has thus far focused primarily on the home as the central unit of measurement. Examining the environment surrounding schools could have important policy implications, as policy makers have the ability to enact zoning laws near public schools that could influence the built environment. Policies that use the built environment to promote child health around a public school would reach a great number of children and families, influencing the health of the entire community. It should be noted that of the built environment constructs examined in this study, access to a greater number of food stores was the only construct that remained associated with MVPA when controlling for other factors. Future directions should include examining how the built environment around schools is associated with dietary behaviors among adolescent girls to determine if the energy expenditure associated with increased access to food stores is negated by energy intake related to access to food stores.

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