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Relations of Neighborhood Environment Influences, Physical Activity, and Active Transportation to/from School across African American, Latino American, and White Girls in the United States

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Abstract

Background—Neighborhood environment influences may be particularly important for understanding physical activity (PA) patterns across ethnic subgroups of early adolescent girls.

Purpose—This study examined relationships between neighborhood variables, moderate to vigorous physical activity (MVPA), and active transportation to/from school across African American, Latino American, and White early adolescent girls living in an urban/suburban community in the northwestern U.S.A. Relations between the neighborhood variables across ethnic groups also were examined.

Method—The sample comprised 372 African American, Latino American, and White girls living in the U.S.A. (mean age= 12.06 years; *SD*=1.69).

Results—Data were analyzed using multiple-sample structural equation modeling. Results showed that girls' MVPA was positively related to physical activity facility accessibility and negatively related to age. Active transport was positively related to physical activity facility accessibility, neighborhood walkability, and age, and negatively related to distance to the nearest school and household income.

Conclusions—Findings highlight the importance of both perceived and objective neighborhood influences on girls' MVPA and active transport. Consistencies in findings across African American, Latino American, and White girls suggest that neighborhood-level PA promotion has the potential for broad impact across all three ethnic groups.

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Compliance with Ethical Standards: All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all individual participants included in the study.

Conflict of Interest The authors declare that they have no conflict of interest.

Keywords

Physical activity; Active transport; Neighborhood; Ethnicity; Girls

Introduction

The study of girls' PA is becoming increasingly important. PA declines throughout childhood and adolescence, particularly in girls [1–4], and there is considerable variation in the amount of PA in which adolescent girls engage. Youth obesity and PA rates have been shown to differ by race and social class, and adolescent obesity is most prevalent among non-White females [1, 4, 5]. While PA promotion is important for all youth, in the U.S.A. it is especially critical for African American and Latino American girls, and has implications for the entire life course. The trend toward decreasing PA starts in childhood, escalates in adolescence, and continues into adulthood [5–7]. Understanding PA patterns, correlates, and determinants among ethnically diverse girls is important if we are to address declining PA levels and promote greater PA in at-risk subgroups.

There has been growing interest in Ecological Health Behavior theories and models as a useful framework for understanding PA. Studies of the characteristics of environments that may facilitate or hinder PA have the potential to inform interventions and policies to promote PA in the population [8]. Ecological theories and models are considered particularly beneficial because they include the influence of people's physical and sociocultural surroundings as well as intrapersonal factors [8–10]. Ecological models incorporate a wide range of influences at multiple levels, including, but not limited to, the neighborhood social and built environments [8].

The Ecological Model posited by Sallis and colleagues [8] was used as the theoretical and conceptual framework for the current study. Sallis et al.'s model [8] consists of four domains of active living: active recreation, active transport, household activities, and occupational activities. Given the present study's focus on youth, the focus here is on measures related to two of these PA domains—active recreation and active transport (AT)—specifically, general levels of PA (e.g., moderate to vigorous PA [MVPA]), and AT to/from school. AT to/from school has been related to overall levels of youth PA [11]; however, only 14 % of school students in the U.S.A. walk or bike to school and percentages decrease rapidly from 8th to 12th grades [12].

According to the Ecological Model [8], behavior settings are described as places where PA may occur, such as one's neighborhood. Both built and perceived environmental factors may help or hinder PA, and these factors may differ by racial/ethnic group. According to Sallis et al. [8], it is important to consider specific characteristics of the behavior setting as well as access to recreational opportunities. Environments rich in resources (such as affordable and accessible recreation facilities, aesthetic scenery) likely facilitate PA, whereas environments that lack PA resources or pose barriers may limit activity [9, 13–19]. In the neighborhood behavior setting, characteristics vary considerably in terms of recreation programs and facilities, transportation infrastructure, ease of movement, and social environment—all of which may influence youth PA and may differ across different ethnic groups. In the U.S.A.,

socioeconomic (SES) factors are tied to racial/ethnic disparities, which can lead to disparities in access to neighborhood PA resources. In most U.S. cities, African American and Latino American families are more likely to live in lower-income, lower-resource neighborhoods than White families as a result of historical segregation, failed attempts to desegregate, and structural racism. As a result, these ethnic groups have access to fewer recreational facilities, fewer and lower-quality sidewalks, and fewer aesthetic amenities (e.g., pleasant scenery), and they may be in more danger from crime and traffic than White residents—which can influence PA such as walking, cycling, and jogging [20–23].

With regard to AT specifically, research shows that travel distance is the most consistent built-environment predictor of AT to school [24], although walkability (high street connectivity and low traffic volume) may also play a role [25]. There is limited research on the role of income and socioeconomic status on AT to/from school, and about differences in AT across different ethnic groups, although some studies have linked greater AT to/from school with non-White and lower-SES students [24, 26].

In line with the Sallis et al. [8] framework, personal perceptions about the behavior setting also influence PA. Differences in youth PA may be explained in part by differences in perceptions of neighborhood PA barriers and opportunities, and neighborhood surroundings [27–29]—and these perceptions may be tied to racial/ethnic group. Barriers to PA such as perceived neighborhood social cohesion/control, safety, and physical and social disorder have all been related to PA [18, 28]. In general, non-White residents compared to White residents in the U.S.A. tend to perceive their neighborhoods as less safe, less pleasant, and posing more barriers to PA [30, 31].

Many questions remain about which neighborhood variables are most correlated with youth PA, and there has been very little focus on neighborhood correlates of youth PA across ethnic subgroups [13]. Researchers advocate the importance of including both perceived and objective measures in studies of the environment and PA whenever possible in order to compare and contrast the impact of measurement mode on both total and domain-specific PA [13, 18, 32]. Questions also remain about the extent to which relationships between neighborhood variables and PA differ across racial/ethnic groups. Despite a fairly significant amount of literature on the correlates of PA in pre-adolescent and adolescent girls, few studies include an ethnically diverse sample. Race/ethnicity analyses allow more meaningful conclusions to be made about the relationships between variables and PA among different populations, and have the potential to provide useful information about how to promote activity for varying and diverse groups [33, 34]. Researchers have advocated for studies that conduct subgroup-specific analyses to help understand for whom built and social environments are most influential [8, 13].

The purpose of the present study is to determine: (a) whether relations between neighborhood variables and MVPA and AT to/from school differ across subgroups of African American, Latino American, and White urban early adolescent girls living in the U.S.A., controlling for effects of age and family income; and (b) the extent to which relations between the neighborhood variables are similar or different across the three ethnic groups of girls. Objective and subjective neighborhood environment variables included

perceived neighborhood barriers to PA, perceived accessibility to neighborhood PA facilities, objectively measured neighborhood walkability, objectively measured distance from home to the nearest park, and objectively measured distance from home to the nearest school.

Method

Sample

Data are from a study of 372 African American (*n*=128), Latino American (*n*=120), and White (*n*=124) girls residing in the urban-suburban area of Portland–Gresham, Oregon, in the U.S.A. As part of the study design, families having a 10-, 12-, or 14-year-old girl were randomly recruited from 41 socioeconomically diverse and geographically dispersed neighborhoods using telephone, door-to-door, and word-of-mouth methods. Of eligible families, approximately 67.8 % agreed to participate. The target girl and a parent completed assessments in their home. Girls younger than 12 years of age were assessed with an interview. Spanish-language assessments were provided for Spanish-speaking participants. Assessment visits lasted about 30–75 min. Participants completed individual assessments in private, away from other family members, to enhance confidentiality. For 7 days, girls were asked to wear a GT3X+ ActiGraph accelerometer device on an elastic band around their waist provided by the project for 24 h a day, including sleep time (except in water). Girls were paid $50 to complete the entire assessment; parents were paid $30. This study was approved by an Institutional Review Board. All adult participants gave informed written consent and all girls gave informed written assent prior to study participation.

Approximately equal numbers of African American, Latino American, and White girls were recruited from each age cohort. Girls were invited to participate in the study if they met inclusion criteria and self-identified with African American, Latino American, or White ethnicity—even if the girl was of mixed ethnic descent. Mean age was 12.06 years (*SD*=1.69). The annual household income for the sample was 12.7 % <$10,000, 15.2 % from $10,000–$19,999, 23.7 % from $20, 000–39,999, 16.3 % from $40,000–$59,999, 11.5 % from $60,000–$79,999, and 20.6 %>$80,000.

Measures

Youth physical activity—Girls' PA was measured via accelerometers. We calculated mean minutes per day engaged in combined moderate, vigorous, and very vigorous activity (MVPA). Child-specific cut points, derived from Freedson, Pober, and Janz [35], were used to determine intensity of activity using ActiLife5 software. The Freedson et al. [35] cut points are 500–3,999 counts per minute (CPM) for moderate activity, 4,000–7,599 CPM for vigorous activity, and 7,600+ for very vigorous activity. These cut points were based on the formula METs=2.757+ (0.0015×CPM)–(0.08957×age)–(0.000038×CPM×age) with assumed thresholds of 3, 6, and 9 METs for moderate, vigorous, and very vigorous activity, respectively (which produce cut point boundaries of 500, 4000, and 7600 CPM, respectively). The Freedson et al. [35] cut points were calibrated specifically for children and have been widely used in previous research with youth [36] and specifically in studies of girls' physical activity [37]. Accelerometry is accepted as a reliable and valid method for

measuring PA in population-based studies of free-living individuals [38–41]. In the present study, compliance for wearing the device was moderately high, with 89 % of girls providing at least 5 days of valid data. Days of accelerometer use ranged from 0 to 7 (mean= 5.66 days [*SD*=1.18]). All data were used in the analyses.

Active transportation to/from school—To measure active transportation to and from school (AT), we created two survey items for both targets and parents. Girls were asked, "How many days in a typical school week do you walk, bike, skateboard, rollerblade, or ride a scooter to [from] school?" with responses ranging from 0 (0 days) to 4 (every day). The two items (to and from school) were summed. Because of the correlation between parents' and girls' responses (r=0.70, p<0.001), girls' summed responses were averaged with parents' summed responses to create an AT to/from school variable.

Neighborhood variables—Perceived neighborhood barriers to PA were measured with 13 items based on prior measures [42–44]. Girls were asked to rate the extent to which different barriers/hazards (e.g., traffic, crime, lack of sidewalks) discouraged them from doing PA in their neighborhood on a scale from 1=never to 4=very often. A total neighborhood barriers scale score was created by averaging responses across the 13 items, with higher scores indicating greater perceived barriers to PA. The internal consistency reliability coefficient for this scale was 0.85. To measure accessibility to neighborhood PA facilities, girls noted whether they had access to (0=no, 1=yes), could walk to (0=no, 1= yes), and were comfortable at (0=not at all, 1= somewhat or yes) outdoor park(s), school playground(s) or field(s), and community center(s). For this new scale, all items were summed to create a summary score (range=0–9), with higher scores indicating more accessible neighborhood PA facilities. Objective geographic information systems (GIS) data were used to create a walkability index within a 1.6-km buffer of each girl's home, as well as variables measuring the distance to each girl's nearest park and school, using ArcGIS Desktop software (version 10.0) [45]. This buffer size was selected based on past PA research and recommendations [46]. The walkability index score was calculated as the density of street segments weighted by percent of sidewalk along the segment (i.e., sidewalks on both sides for the entire length of a segment would receive a weight of 100; segments with full sidewalks on only one side and no sidewalks on the other would receive a weight of 50). Higher scores indicate a more favorable environment for walking. Distances to the nearest park edge and school property were estimated using a raster-based pedestrian network. The cell size for the rasters was 27 m by 27 m; thus, values from zero to 27 mean that the feature fell within the same cell as the participant's residence (i.e., less than 27 m from the house) or directly adjacent to the participant's lot or across the street (27 m from the house). This cell size was chosen for the purposes of street resolution and aggregation of data to the default grid size (approximately the width of a standard Portland city block plus the adjacent right-of-way).

Structural equation modeling (SEM) is sensitive to large discrepancies in values thus GIS distances were divided by 1,000 so that values for all variables in the model fell within a similar range.

Demographic variables—Age and family income per capita were included in the models to control for their possible effects on PA and AT to/from school. For income, parents reported 1 (under $10,000), 2 ($10,000–$19,999), 3 ($20,000 to $39,999), 4 ($40,000= $59,999), 5 ($60,000–$79,999), or 6 ($80,000 or more); the 1–6 scores were divided by the number of family members to adjust for household size and the resulting score was used in the analyses.

Statistical analyses

Structural equation modeling (SEM) was employed to examine relations between neighborhood environment variables, MVPA, and AT to/from school. MVPA and AT variables were regressed on neighborhood variables as well as on age and family income. MVPA and AT were specified to covary. All neighborhood variables covaried with each other and with age and family income. To test for differences across the three ethnic groups, multiple-group SEM was employed. Multiple-group analyses permit simultaneous evaluation of results across multiple populations [47, 48]. In this study, the analyses tested for significant differences by ethnic group in regression parameters, covariances, and intercepts and variances. Models were estimated using Mplus software (version 6.1) [49]. With a sample size of approximately 120 per ethnic group, the present study had greater than 0.95 power to detect significant regression effect differences across the three ethnic groups.

Results

Model specification

Figure 1 illustrates the model of hypothesized relationships between neighborhood variables, MVPA, and AT to/from school.

Means and variances for each of the variables in the model are shown in Table 1. There were significant mean differences across groups for income (White families had higher incomes than African American and Latino American families), MVPA (African American girls had greater MVPA than Latino American and White girls), neighborhood barriers to PA (White girls had fewer perceived neighborhood barriers to PA than African American and Latino American girls), and 1.6-km walkability (Latino American girls lived in less-walkable areas than African American and White girls).

Initially, constraints were placed across the three ethnic groups requiring equality of parameter estimates for the regression coefficients, covariances, intercepts, and variances of all variables in the model (except for age and family income means and variances, which were left unconstrained). Model fitting procedures for this hypothesized fully constrained model yielded the following fit indices: $\chi^2(68, N=372)=124.182$, $p<0.001$, Comparative Fit Index (CFI)=0.763, Tucker–Lewis Index (TLI)=0.843, and Root Mean Square Error of Approximation (RMSEA)=0.082. Results of the modification indices (MI) in Mplus revealed that there were a number of constraints across groups that, if relaxed, would result in a significant chi-square decrease, and which indicated significant differences across the

three ethnic groups. The model was rerun, removing one constraint at a time, until there was no indication of further significant differences in parameters across groups.

Model fit

The final model (with significant cross-group constraints relaxed) resulted in the following acceptable fit indices: $\chi^2(64, N=372)=63.394$, $p=0.498$, CFI=1.000, TLI=1.002, and RMSEA=0.000.

Regression effects

Significant regression effects in the model are shown in the figure, and were consistent across the three ethnic groups. More MVPA was significantly associated with younger ages (regression coefficient=−19.673, $p<0.001$) and with greater accessibility to neighborhood PA facilities (coeff=2.032, $p<0.05$). More AT to/from school was significantly associated with older ages (coeff=0.159, $p<0.05$), lower income (coeff= −0.760, $p<0.05$), greater accessibility to neighborhood PA facilities (coeff=0.220, $p<0.001$), greater neighborhood walkability (coeff=0.349, $p<0.05$), and shorter distance to the nearest school (coeff= −0.689, $p<0.001$).

Correlations

Significant correlations also are presented in the figure and were consistent across the three ethnic groups. MVPA was positively related to AT to/from school ($r=0.105$, $p<0.05$), older age was associated with fewer perceived neighborhood PA barriers ($r=-0.163$, $p<0.0.05$), more neighborhood PA barriers was correlated with less neighborhood walkability ($r=-0.235$, $p<0.05$), and greater neighborhood walkability was related to less distance to the nearest park ($r=-0.189$, $p<0.05$) and to the closest school ($r=-0.212$, $p<0.05$ for African American girls; $r=-0.189$, $p<0.05$ for Latino American and White girls).

Discussion

Based on the theoretical Ecological Model of Sallis et al. [8], the current study focused on the influence of the neighborhood behavior setting on two active living domains of relevance to youth—a general measure of PA (MVPA) and AT to/from school—to determine whether neighborhood correlates of each were similar or different across three ethnic groups of girls. A consistent finding across both PA measures and all three ethnic groups was that greater perceived neighborhood PA facility accessibility (measured with participant ratings of access to, ability to walk to, and feeling of comfort at neighborhood facilities) was positively and significantly related to both MVPA and AT to/from school. This finding supports the Sallis et al. [8] model, which specifies the importance of the perceived environment (accessibility, comfort, convenience) and extends prior research and reviews indicating that the presence of nearby recreational facilities is important for youth PA [50, 51]. Whitt-Glover et al. [29] stressed the importance of keeping local schools, community centers, churches, and other community-based gathering places open and accessible for community users in order to increase PA opportunities in one's neighborhood. The only other variable to emerge as a significant correlate of MVPA was age, with MVPA

significantly associated with younger ages. This finding is consistent with prior research indicating that levels of girls' PA decline as they get older [2, 6].

Objectively measured neighborhood environment variables were significantly related only to AT to/from school. Ecological models [8] and prior studies highlight the potential importance of environmental characteristics (e.g., walkability) for promoting PA in a particular behavior setting, such as one's neighborhood [25]. In the current study, greater walkability was positively related to more AT to/from school across all three ethnic groups. Greater walking infrastructure in neighborhoods has been shown to influence PA [22, 50] among adults in particular, but there has been less evidence of an association among young people [22]. Neighborhood infrastructures that support and allow engagement in active forms of transportation include the presence of sidewalks, walking trails, and bicycle lanes, and increased availability of public transportation, and are important because they provide AT and PA choices for residents [29]. It has been suggested that this might be particularly important in racially/ethnically diverse and lower-SES communities, which tend to have fewer built and social environmental supports for PA [22]. In the current study, although there were differences in 1.6-km walkability across the three ethnic groups (i.e., Latino American girls lived in less-walkable areas than African American and White girls), walkability was a significant and consistent correlate of AT to/from school for all three subgroups, thus indicating its potential importance for all girls.

Distance to school also emerged as a significant correlate of AT to/from school. Shorter distance to school was associated with higher levels of AT to/from school across all three ethnic groups. This finding supports prior research arguing that travel distance is the most consistent built environment predictor of AT to school [24]. In addition, some studies have linked demographic factors such as income and SES status with AT to/from school, and/or suggested greater AT to/from school among non-White students [24, 26]. The current study found a relationship between income and AT to/from school such that lower income was related to more AT. However, no ethnic group differences were found for AT to/from school between African American, Latino American, and White girls. Older girls engaged in more AT to/from schools than did younger girls, which may be a reflection of greater willingness by parents to let their children make their own way to school as they get older. However, it should be noted that although older girls engaged in more AT to/from school compared to younger girls, younger girls had higher levels of MVPA; this suggests that older girls' additional engagement in AT was not enough to compensate for declines in other types of PA occurring with age.

Overall, the study found more significant relations between neighborhood environment measures and AT to/from school versus MVPA. This may be partly a function of the more domain-specific nature of the AT measure. Although not specifically measured in this study, there is anecdotal evidence that most girls attended a school in their neighborhood, which increased the likelihood that measures of the neighborhood environment (e.g., the 1.6-km walkability buffer and distance to school measures) would be related to AT to/from school. MVPA is a much broader measure of PA. At least some of this PA likely occurred outside the objectively measured neighborhood behavior setting (1.6-km buffer), lessening the likelihood that neighborhood variables would relate to overall MVPA. This might also help

explain why the only neighborhood variable related to MVPA was the perception of neighborhood barriers, as perceptions are not limited to an objective area of measurement. Ding et al. [13] posit that the mode of measurement influences associations between the neighborhood environment and youth PA. Reported measures, such as the measure of AT in this study, capture specific domains of PA, which may provide a more precise test of association. This finding is consistent with ecological theories/frameworks and literature indicating that the environmental influence on PA is domain- and context-specific [8].

An interesting significant mean difference in PA emerged across ethnic groups. African American girls had significantly more MVPA than Latino American and White girls. Previous self-report data has suggested that African American youth are less active than White youth; however, recent data using objective measures similar to the current study showed that African American children ages 6–19 years were more likely to meet recommended PA levels than were White children [22]. In addition, it has been suggested that African Americans may have increased their activity in response to the recent national focus on preventing obesity in high-risk populations [22]. Further research is needed among diverse ethnic youth to replicate and explicate these findings.

The current study had several limitations, including the use of cross-sectional data, which does not permit directional or causal testing of the effects of neighborhood environment variables on MVPA and AT to/from school. Future studies are needed to document relations among these variables over time. A major limitation of the study was that AT to/from school was measured subjectively, while MVPA was measured objectively. This might have affected the differences in associations found between covariates with MVPA and AT to/from school. Additionally, there are limitations with accelerometer data, including the inability to capture bicycling, skateboarding, rollerblading, and water-based physical activities. It also is important to note that, although statistically significant, most of the effects of the neighborhood variables in the study were small and explained minimal amounts of variance in MVPA and AT. Thus, much of the variance in MVPA and AT was unexplained. PA is a complex behavior that is believed to be influenced by multiple behavior settings and numerous intrapersonal factors [8]. It is likely that more variance in MVPA and AT would be explained with the inclusion of a broader array of contextual setting and personal variables. In addition, the neighborhood environment covariates analyzed represent only a few of many neighborhood covariates potentially important to adolescent girls' PA and AT. The analyses controlled for age and household income, but there may be other demographic factors that should be controlled for in future studies. It is also possible that the effects of the covariates exert themselves in a more interactive rather than direct manner, which was not tested in this study due to the limited sample size. Future studies should consider including interactions between hypothesized covariates. In particular, it is possible that income may interact with covariates of MVPA and AT and influence the location of girls' PA, and thus the importance of certain neighborhood variables on PA outcomes. Further, future studies would benefit from actual, rather than anecdotal, evidence that the nearest school was attended by participants.

There are also limits to generalizability. In this study, objectively measured MVPA per day for African American, Latino American, and White girls was higher than reported in some,

but not all, youth studies. There are several possible reasons for this. The most important may be our choice of the Freedson et al. [35] cut points for moderate, vigorous, and very vigorous PA. These cut points were chosen because they have been validated in previous studies with a similar population. However, it is important to note that a variety of cut point thresholds for children have been proposed by different researchers, some of which are more restrictive in defining moderate activity. For instance, Trost et al. [38] defined moderate activity as 4–5.99 METs and vigorous activity as 6+ METs, which resulted in cut point boundaries of 2200 CPM for moderate activity and 4,136 for vigorous activity, and Treuth et al. [52] defined even higher cut point boundaries of 3,000 CPM for moderate activity and 5,201 for vigorous activity. Thus, accelerometer-measured MVPA depends somewhat on the cut points used and therefore is not completely comparable across youth studies. Research using the Freedson et al. [35] cut points would be expected to report more minutes of MVPA on average than studies using more restrictive definitions. Other studies that have employed the Freedson et al. [35] cut points have found averages that are in line with the present investigation [53, 54]. Another reason for the higher MVPA reported here may be that the girls in the present study were more physically active than participants in other studies of broader health behaviors. Finally, relative to other studies, the accelerometers in this study may have captured more MVPA because girls were asked to wear the devices 24 h each day, rather than for a specific number of waking hours.

Strengths of the study include the use of an objective measure of PA (accelerometers), multiple informants (youth and parents), multiple measurement methods (surveys, accelerometers), perceived (survey), and objectively measured (GIS) neighborhood variables, the randomly recruited sample, and an analytical model that examined statistically significant similarities and differences across African American, Latino American, and White girls.

The present study has practical implications. This research shows that, for African American, Latino American, and White girls, perceived PA facility accessibility and age—but not objective measures of the neighborhood environment—were key correlates of MVPA, while AT to/from school was significantly related to both perceived and objective neighborhood measures. As specified by ecological theories and models [8], the study underscores the importance of including measures of both the perceived and objective behavior environment because what people perceive may affect their behavior more strongly than objective measures of “what is”—and not all people perceive their surroundings in a similar way [51]. This study also presents more consistencies than differences in findings across African American, Latino American, and White girls, an unanticipated result. It is possible that the lack of differences across ethnic groups may be due to the specific location studied—or to a general shift in cultural norms about PA, which may have a homogenizing effect on environmental PA influences across ethnic groups. The similarities in results suggest that neighborhood-level PA promotion has the potential for broad impact across all three ethnic groups. Efforts to create well-connected neighborhoods—with sidewalks, walking trails, and bicycle lanes—that offer accessible, welcoming, and good-quality recreational facilities and parks may increase PA by offering more choices and by influencing parents' and children's perceptions about the safety of their home neighborhoods [21]. Parks and other recreational facilities that appear better maintained may be seen as

more attractive and subsequently viewed as being safer if more similar aged youth use those facilities. Additionally, neighborhood schools that establish cooperative agreements allowing community use of resources such as gymnasia may make PA facilities more accessible to potential users.

Future research should continue to explore the effects of both the perceived and objective neighborhood environment on youth PA, as well as multiple and diverse measures of overall PA and specific activity domains across ethnic and gender subgroups. Future studies also should include neighborhood measures along with other contextual factors (e.g., demographic, personal, family, peer, and school) to determine the relative influence of these factors on PA across different youth subgroups. Increased understanding of environmental influences on youth PA, in concert with other influences, across and within population subgroups, will help researchers and practitioners better target public health efforts to promote PA among groups most at risk for inactivity and obesity [55].

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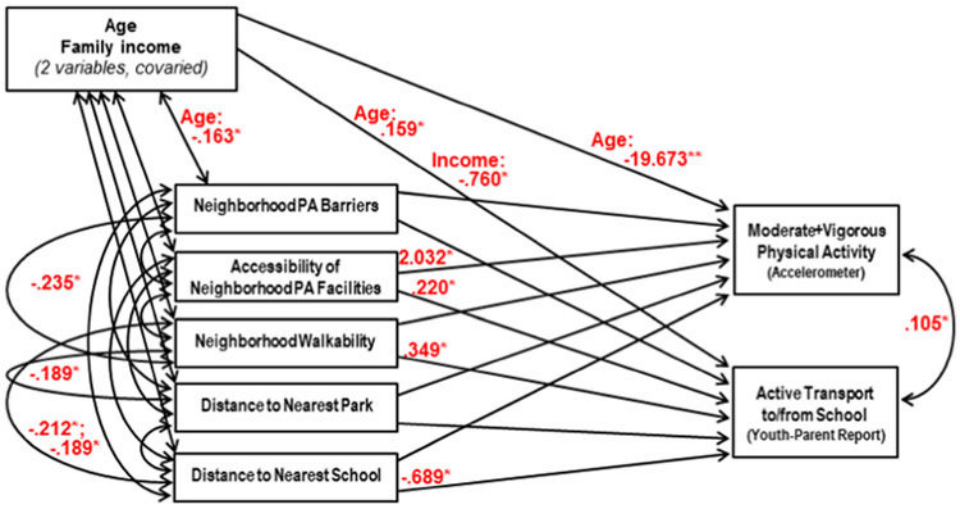

Fig. 1.

Final Model. Model of hypothesized relationships between neighborhood variables, MVPA, and AT to/from school. The multiple-group model in this study estimated regression parameters, covariances, and means/intercepts and variances—and tested for significant differences in these estimates—across African American, Latino American, and White ethnic groups. Significant regression weights and correlations from the final model are noted in the figure; * and ** are significant at $p \leq 0.05$ and $p \leq 0.001$, respectively

Table 1
Descriptive statistics of variables in the models

	African American Mean (SD)	Latino American Mean (SD)	White Mean (SD)
Self-reported age (years)	11.94 (1.61)	12.02 (1.67)	12.08 (1.62)
Self-reported income per capita (six-point scale divided by number or family members in the household)[a]	0.75 (0.46)	0.66 (0.49)	**1.08** (0.45)
Accelerometer-measured minutes/day MVPA	**100.40** (55.43)	87.98 (49.26)	86.63 (44.25)
Self-reported days AT to/from school[b]	2.39 (2.64)	2.50 (2.88)	1.94 (2.64)
Perceived neighborhood PA barriers (scale=1–4; higher scores indicate greater perceived barriers)	1.49 (.49)	1.45 (.44)	**1.35** (.42)
Perceived accessibility of PA facilities (scale=0–6; higher scores indicate greater accessibility)	6.41 (2.20)	6.23 (2.01)	6.13 (1.94)
GIS-measured 1.6-km walkability index (higher scores indicate a more favorable environment for walking)	3.44 (1.01)	**3.20** (.86)	3.55 (.99)
GIS-measured distance to closest park (meter/1,000)	0.44 (0.28)	0.47 (0.27)	0.43 (0.25)
GIS-measured distance to closest school (meter/1,000)	0.47 (0.22)	0.48 (0.23)	0.48 (0.23)

Note. Means in bold type signify a significant difference between that group and the other two groups

[a] Parents reported income as 1 (under $10,000), 2 ($20,000 to $39,999), 3 ($40,000=$59,999), 5 ($60,000-$79,999), or 6 ($80,000 or more). This value was then divided by the number of family members to adjust for household size

[b] Girls and parents reported how many days girls transported themselves to school, ranging from 0 (0 days) to 4 (every day) and how many days girls transported themselves home from school. Girls' responses to the two items were summed, parents' responses to the two items were summed, and then the two summed scores were averaged to create an AT to/from school variable