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Neighborhood Socioeconomic Status and Non School Physical Activity and Body Mass Index in Adolescent Girls

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Abstract

Background—Socioeconomic status (SES) has well known associations with a variety of health conditions and behaviors in adults but is unknown in adolescents.

Methods—Multilevel analysis was conducted to examine the associations between individual and neighborhood-level measures of SES and physical activity and body mass index in a sample of 1554 6th grade girls selected at random from 36 middle schools across 6 geographic regions in the United States that participated in the Trial of Activity for Adolescent Girls (TAAG). Data on parental education and employment, and receipt of subsidized school lunch were collected by questionnaire. Neighborhood-level SES was measured by the Townsend Index. Nonschool physical activity levels were measured by accelerometer and type, location and context was measured using a 3 day physical activity recall (3DPAR).

Results—After controlling for race, lower parental education and higher levels of social deprivation were associated with higher BMI. In a model with both variables, effects were attenuated and only race remained statistically significant. None of the indices of SES were related to accelerometer measured physical activity. Bivariate associations with self-reported Moderate-Vigorous Physical Activity (MVPA) location and type (3DPAR) varied by SES.

Conclusion—Among adolescent girls in the TAAG Study, the prevalence of overweight is high and inversely related to individual and neighborhood SES.

Keywords

physical activity; BMI; adolescents; socioeconomic status; GIS

Numerous studies have linked differences in health,[1–4] markers of disease risk,[5] and health-related behaviors[6–9] to inequalities in socioeconomic status (SES) in childhood and over the life course. In general, the studies have found that lower SES in childhood and over the life course is associated with increased risk of engaging in unhealthy behaviors, such as lack of exercise and poorer health by midlife. A recent analyses of 30 year trends in US adolescents in the National Health and Nutrition Examination Study showed socioeconomic inequality of overweight across ethnic and gender groups as well as variations over time.[9] In the late 1980s, Liberatos et al (1988)[10] among others criticized the use of individual indices of SES for failing to capture the social and physical environments that might influence health. Over the past 20 years, a growing literature has evolved which focuses on determining whether the socioeconomic status of the community in which individuals live also plays a role in health behaviors[11,12] and outcomes.[13–15] This research is based on the premise that community-level resources are linked to health and behavior through a number of intermediate pathways. For instance, a common hypothesis posits that inequalities in community-level SES influence health behaviors through differential exposure to physical activity resources (eg, recreational facilities, bike lanes, sidewalks), hazardous conditions (eg, crime, traffic), and stores selling fresh produce, or health through differential exposure to environmental pollutants or toxic substances such as lead or asbestos.[16,17] There has been relatively little testing of these hypothesized pathways between community level SES and health or health-promoting behavior, primarily because until recently scant data have been available to test these pathways.

Although the effects of socioeconomic deprivation are thought to be cumulative over the life course, the time lag before differences in health behaviors or outcomes can be seen has not been well characterized. In particular, although several studies have evaluated the effects of individual and neighborhood level SES on physical activity and weight status in adults,[18–20] few have explored these relationships in children and teens. Those that have explored these relationships in large national longitudinal samples have found lower SES groups had reduced access to facilities which was associated with decreased PA and increased overweight[12] and adolescents living in urban neighborhoods more likely to be overweight.[21] In the face of growing concerns about increasing physical inactivity and obesity in youth and the future risk of cardiovascular disease, diabetes, and high blood pressure associated with these problems, greater research in this area is needed.

The literature on socioeconomic inequalities in health use an array of measures to define the concept of socioeconomic status. Individual-level socioeconomic status has traditionally been defined by education, income, occupation, or a composite of these measures,[22] and neighborhood-level SES is frequently assessed using census tract measures, separately or using an aggregate index such as the Townsend Index, an index of social deprivation based on unemployment, overcrowding, housing ownership, and access to private transport (ie, car).[22,23] The primary limitations of these early measures include methods that use artificial (administrative) boundaries such as census tract, or block group as defined neighborhoods. New mapping technology allows the creation of boundaries specific to individual address locations. The variables chosen for this analysis mirror these same indices, as closely as possible to facilitate comparisons with accumulated literature. Boundaries were created as radii around each individual address as opposed to using administrative boundaries, which depending on where an individual falls in a census tract could over or underestimate the SES status of a particular contiguous neighborhood. This paper identifies 2 individual and 1 aggregate neighborhood-level measures of SES, and attempts to parse their independent and

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shared influences on two important risk factors for future ill health (objectively measured physical activity and weight status) in a geographically and racially diverse sample of adolescent girls who participated in the Trial of Activity for Adolescent Girls (TAAG). A secondary aim is to examine the relationship between SES and Physical activity context (type and location of activity). To begin to explore these relationships and suggest future directions for others to explore the relationship between SES and physical activity this paper reports on whether girls who live in higher vs. lower SES neighborhoods tend to have a higher ratio of activity performed in their home or neighborhoods compared with school based before or after school activity, and leisure to nonleisure activity (eg, sports vs. child-care). A proposed conceptual model of direct hypothesized relationships between SES, BMI and physical activity is shown here (Figure 1) where the mechanism by which SES related family, school and neighborhood factors may have direct or indirect influences on physical activity and BMI. The specific potentially additional SES related influences are not investigated in this study however they are discussed to explain the results in a broader context.

Methods

Participants and Study Design

TAAG is a multicenter group-randomized trial funded by the National Heart, Lung, and Blood Institute, designed to test the effectiveness of a school and community-linked intervention to reduce the usual decline in moderate to vigorous physical activity (MVPA) among adolescent girls.[24] In the fall/winter of 2003, healthy 6th grade girls, age 11 to 12 years, were recruited from 36 schools participating in TAAG at field centers located in Baltimore, MD, Minneapolis/ St. Paul, MN, Columbia, SC, Tucson, AZ, San Diego, CA, and New Orleans, LA in collaboration with NHLBI staff, and coordinated by the University of North Carolina, Chapel Hill. A random sample of 60 girls was targeted for recruitment from each of the 6 school centers. Any girl in the random sample who was unable to read and understand English; had been told by a physician to avoid physical activity; or had other medical contraindications was considered ineligible and replaced with another eligible girl in the school. Each participating institution's Human Subjects Review Board approved the protocol. Consent to participate was obtained from 1 parent, and assent was obtained from each participant. Parental consent and student assent were obtained for 1721 of the 2160 eligible girls for an average recruitment rate of 80%.

Variable Descriptions

Outcome Measures

Body Mass Index (BMI): Following a standardized protocol, the participant's weight was measured twice to the nearest 0.1 kg on an electronic scale (Seca, Model 770, Hamburg, Germany). Height was measured twice to the nearest 0.1 cm using a portable stadiometer (Shorr Height Measuring Board, Olney, MD). The height and weight values were the average of the 2 readings. BMI data computed as weight (kg) divided by height (meters) squared. Girls were classified as underweight (< 5th percentile of weight-for-height), normal (5–85th percentile), at-risk for overweight (85–95th percentile), and overweight (> 95th percentile) based on the age and gender specific tables provided by the CDC (CDC, NCHS accessed 1/15/06).

Physical Activity; Objective Measure (Accelerometry)—This analysis focused on nonschool physical activity defined as the sum of weekend activity and weekday activity between 3 PM and midnight. Activity during school was excluded since it was less likely to be affected by the neighborhood characteristics of the girls in the study.

Physical activity was assessed using the Actigraph accelerometer (Manufacturing Technologies Inc. Health Systems, Model 7165, Shalimar, FL). Actigraph measures have previously been shown to be valid indicators of energy expenditure and physical activity in youth.[25,26] Girls were instructed to wear the accelerometer on a belt around their waist over their right hip for a 7-day period, except when they were sleeping, bathing, or swimming. Accelerometers were initialized to begin data collection at 5:00 AM the day after they were distributed to girls (giving 6 complete days of recorded activity), and the epoch of integration was set at 30 seconds. Because the monitor records even slight motion as a nonzero count, a sustained 20-minute period of zero counts was considered a non-wearing period, and missing data were imputed using the Expectation Maximization (EM) algorithm as described previously.[27] Girls who failed to provide at least 1 day with a minimum of 6 hours of data were excluded from this analysis as the accuracy of imputation was deemed too imprecise.

Accelerometer counts were summarized into time spent in each of 4 activity intensities with thresholds for sedentary, light, moderate, and vigorous activity intensity ranges of < 50, 51 to 1499, 1500 to 2599, and ≥ 2600 counts/30 s respectively.[28] In addition, counts ≥ 1500 counts/30 s were converted to their metabolic equivalent (MET; multiples of resting metabolic rate in kcal·kg·h-1) and summed to create the total "intensity-weighted" minutes (ie, MET-minutes) of Moderate-Vigorous Physical Activity (MVPA).[27,28]

Physical Activity Type and Context; Self-Report (3DPAR)—A modified version of the 3-Day Physical Activity Recall (3DPAR) was used to provide contextual information regarding the type and location of physical activities the participants performed. The 3DPAR is a modification of the Previous Day's Physical Activity Recall (PDPAR), which has been previously validated in youth.[28,29] and 8th and 9th grade.[25] The 3DPAR form provides a grid divided into 30-minute segments or blocks in which to record activities performed and activity intensity over the previous 3 days. The participants chose from a list of activities, arranged in categories (eating, sleeping, personal care, transportation, work/school, spare time, play/recreation and exercise/workout), and recorded the predominant activity that they performed during each block of time. Participants then chose an intensity level (light, moderate, hard or very hard) at which they performed the activity.

For this study the 3DPAR was used to assess 2 contextual variables: where nonschool activity was performed and type of activity performed. Different codes were provided so that girls could choose between 5 options for where they were (home/neighborhood, school, community facility, other public facility, other) and 4 options for whom they were with (by yourself, with 1 other person, with several other people [but NOT an organized program, class or team], and with an organized program, class or team). The original classification on the 3DPAR included 71 possible activities that were grouped into 4 general types of activity: physical activity, school (club, student activity, marching band, physical education class), transportation (riding in a car/bus, travel by walking, travel by bicycling), and work (job, house chores, yard work). For this analysis, the physical activity classification was split into organized physical activity (ie, team sports) and unorganized physical activity. The "with whom" classification from the 3DPAR was used to identify organized physical activity. If the type of activity was a sport and if the girl specified that that activity was performed with an organized program, class, or team, then we classified that activity as an organized physical activity.

Individual-Level SES Measures

The following individual-level indicators of SES were obtained from the participant by self-report questionnaire.

Parents' Education—Highest level of education attained by either parent based on the following options: less than high school, completed high school, vocational school, some college, completed college, professional training beyond college, or don't know. At least 1 of the parent education variables was "missing" (don't know/nonresponse) for about 50% of the participants; both were "missing" for about 30% of participants.

Parental Employment—Mother and father employment status (employed full or part time, unemployed, not working due to disability, or retired) was coded into the following categories: both employed, 1 employed, and both unemployed.

Free or Reduced Lunch—Current enrollment in the free/reduced lunch program (yes, no, don't know).

Neighborhood-Level SES Measures

School-Level % Free or Reduced Lunch—The percent of students qualifying for free/ reduced lunch at each school was obtained from state department of education websites for each school.

Neighborhood SES—Girls' addresses were geocoded using ArcGIS software. Neighborhood was defined as the area within a 1/2 mile buffer surrounding each girl's place of residence. Socioeconomic status of the neighborhood was defined in terms of the Townsend index, using data from the 2000 US Census. The components of the Townsend index are the percentage of the work-force that is unemployed, average persons per household, percentage of houses that are not owner-occupied, and percentage of households with no vehicle). The component values for a specific girl were interpolated proportionally from the block group data (weighted average of the component values across the block groups within a 1/2 mile buffer around the girl's home, with weights proportional to the block group's area in the buffer, Figure 2). Each of the 4 component scores was standardized (z scores) and summed to form the Townsend index, with higher values of the index representing greater levels of material deprivation (eg, lower neighborhood SES).

Statistical Analyses

The goal of the primary analysis was to determine if physical activity and weight status differ as a function of individual and neighborhood-level measures of SES. The a priori level of significance was set at $P < .05$. Analyses adjusted for the clustered study design using mixed linear models (PROC MIXED in SAS version 9.1, SAS Institute Inc, Cary, NC) for predicting minutes of nonschool physical activity and BMI (continuous variable) with random effects for school and site. Neighborhood was not treated as an additional level of clustering since there was only 1 observation for each neighborhood defined as the 1/2 mile area around each girl's home. Model-based estimates of the mean levels of physical activity or BMI across categories of SES or slope parameters associated with a 1-unit change in the Townsend Index of neighborhood SES were used to describe bivariate relationships. Then, all SES variables were included in multivariate regression models to assess the independent relationships of each factor with the physical activity or BMI outcomes adjusting for race. Model t was compared using the model concordance correlation coefficient (MCCC)[30] and Akaike's Information Criterion (AIC). There is no simple r-squared equivalent for mixed models. The MCCC is a measure of how well the model predicts values of the dependent variable. It ranges from −1 to 1, with 1 meaning a perfect fit and values 0 and below meaning no fit.

The secondary aim was to examine the relationship between SES and context in which physical activities occurred ("where" and "with whom" girls were physically active). The analysis was limited to contextual data on 30-minute blocks on the 3DPAR that were at or above a moderate threshold (ie, ≥ 4.6 METs, equivalent to a brisk walk). A multinomial model was used to compare the location in which activity occurred and type of activity (both 5-level nominal variables) between those girls living in neighborhoods of low vs. high socioeconomic deprivation (defined at the median value of the Townsend Index). The NEST statement in the MULTILOG procedure in the SAS-callable SUDAAN software, version 9.0.1 (RTI, Research Triangle Park, NC) was used to account for the correlation of responses within site, school, and girl (since each girl could contribute multiple blocks of activity).

Results

Of the 1721 girls consented for the study, 1603 girls provided the minimally acceptable amount of accelerometer data necessary to represent weekend and weekday activity, and of these 1554 had addresses that could be geocoded. The excluded group did not differ from the analysis sample on any of the individual indices of SES, but were more likely to attend schools with higher enrollment in the free/reduced lunch program. Participants were primarily white (44.5%), African American (22.1%), and Hispanic (21.8%).

The distribution of BMI and physical activity and indices of SES are shown in Table 1. The mean BMI for the sample was 20.9 ± 4.9 kg/m^2, range 12.7 to 44.8 kg/m^2. Close to 40% of girls were classified as at risk for overweight or overweight. On average, girls accumulated 25 hours of total physical activity over 6 days, with much less accumulated on weekdays after school and on weekend days. Child-reported parental education of either parent included a large number of missing data which necessitated considering other measures of SES. Most girls reported that 1 or both parents were employed. There was relative agreement between self-reported and Department of Education reported proportion of girls participating in free or reduced lunch programs. The social status of neighborhoods spanned a wide range in each category.

BMI and SES

Table 2 shows the distribution of BMI by each of the indices of SES within each race/ethnic group. After adjusting race/ethnicity, lower parental education, lower school SES as measured by percentage of students on free or reduced lunch, and higher social deprivation as measured by the Townsend Index were associated with higher BMI.

Compared with girls whose parents are college graduates, girls whose parents have less than a high school education have almost 1 point higher BMI on average. Girls who do not report their parents' education levels also had higher BMI and measures of SES (ie, Townsend Index, percent of students on free or reduced lunch) to girls with less than high-school parental education. Each additional percentage of the student body that is on free or reduced lunch is associated with an increase of 0.02 points in BMI on average. Note that because we have standardized the neighborhood SES index, the change in BMI associated with a 1-unit increase represents the change associated with a 1-SD increase. Thus, the mean BMI is 0.14 units higher with every additional 1-SD increment in neighborhood SES index. Table 3 shows the mixed model results and model fit parameters (MCCC and AIC) when both individual and neighborhood-level indices of SES are included in the same model. When adjusted for individual SES, the effect of neighborhood SES on BMI was attenuated and no longer statistically significant. As with the race-adjusted results, no associations were found between SES indicators and physical activity in the multivariate model. In general, the model fits were low but slightly higher for the BMI models than the physical activity models.

Non School Physical Activity and SES

We found no significant association between our SES measures and objective (accelerometer) measures of physical activity in models adjusted for race/ethnicity (data not shown). Examination of the 3DPAR data suggests that there are significant differences in the level of total nonschool physical activity between girls in low and high SES neighborhoods.

Physical Activity Context and SES

While quantitative analyses (accelerometer data) show no effects of SES on physical activity or MET-minutes of MVPA, self reported activities from the 3DPAR instrument shows there are qualitative differences in contextual aspects of physical activity ("where" and "with whom" activity occurs) by neighborhood SES. Girls were active most often in their home or neighborhood, accounting for 53% of blocks of MVPA, followed by community facilities (25% of MVPA blocks), schools (8%), other public facilities (8%), or other locations (4%). However, Table 4 shows that MVPA was more likely to occur at home or in a girl's neighborhood vs. elsewhere for girls from neighborhoods of high vs. low deprivation regardless of whether we considered weekday or weekend activity. In particular, girls from neighborhoods of higher deprivation (lower SES) were significantly more likely that girls from neighborhoods with lower deprivation (higher SES) to be active at home or in their neighborhood than at school (OR, 2.5; 95% CI, 1.50 to 4.14) or at a community facility and (OR, 1.7; 95% CI, 1.27 to 2.23).

Most physical activity occurred as part of an organized or unorganized program, class or team (59% and 35% of MVPA blocks, respectively), with other school, transportation, and work-based activities each accounting for approximately 2% of all activity blocks. Table 5 shows the odds ratios for organized vs. other types of activity by neighborhood deprivation status for each weekday and weekend time period. During weekday after-school time periods, girls living in higher deprivation (lower SES) neighborhoods were significantly less likely than girls from lower deprivation neighborhoods to participate in organized activity vs. work-based activity (OR, 0.34; 95 CI, 0.17 to 0.69), or equivalently, higher neighborhood deprivation was associated with a 2.9 times higher odds of accumulating activity as part of work vs. an organized program. Regardless of time period, girls from neighborhoods of higher deprivation also tended to be less likely to engage in organized vs. transportation-based activity than girls from lower deprivation neighborhoods although this association did not always reach statistical significance.

Discussion

We found that adolescents with lower individual and area-level SES had higher BMI than adolescents with higher SES. No relationships were found between SES measures and accelerometer measured physical activity. However, we did find qualitative differences (3 DPAR) in types and location of activity where lower SES girls' were more likely to participate in moderate-vigorous activities at home during the weekday and weekend whereas higher SES girls were most likely to participate in MVPA at school or community facilities during the week and community facilities and schools on weekends. 3DPAR data illustrates that lower SES girls spent fewer blocks of MVPA time (during weekdays and weekends) in any organized activity compared with higher SES girls and more time in informal and spontaneous activity (recreational, individual, unorganized). Higher SES girls spent more MVPA time participating in organized activities (team sports, program, or class) during both weekdays and weekends. These differences in types of activity between low and high deprivation (low SES) neighborhoods may be a function of limited resources where more financial and supportive (eg, transportation) resources are needed to enable adolescents to participate in organized activities. Despite finding an association between SES and BMI, SES was not found to be a determinant of accelerometer measured physical activity levels. Therefore, the data from this study do not support the hypothesis that socioeconomic differences in activity leads to the emergence of weight differences. One possible explanation for this finding is that there are other pathways that better explain how the social environment influences BMI for instance, dietary factors and the impact of neighborhood[31] psychosocial hazards[32] and family as a source of chronic stress on the neuroendocrine system[33] and may act as "risk regulators"[34] in this complex relationship. In addition, the finding that SES measures were significant over and

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above race/ethnicity suggests that there are common features to low SES environments in the groups in our study that may act as barriers to out of school activity and healthy eating for adolescent girls previously discussed.

Others have debated the association with poorer neighborhoods and poorer access to resources for healthy diets and physical activity.[35] Also intriguing is the possibility that physical activity may buffer the effects of chronic stress on adiposity in youth.[36] Unfortunately, the data needed to test these pathways are not available. Another interpretation, originally proposed by Chen[37] suggests that SES differences in activity may be diminished because of "homogenization of youth through a common culture that crosses SES lines." The same SES factors that are strongly related to physical activity in adulthood may be unassociated (or weakly associated) with physical activity in adolescence because there is less variation in activity during this period of the lifecourse. Indeed, previous studies examining the relationship between SES and physical activity among adolescents have yielded mixed results; 2 out of 8 found no association, and two of the significant associations were not evident in girls.[37]

While the influence of SES on obesity risk factors is complex, many believe that lower SES populations are more likely to live in obesogenic environments with greater exposure to fast food outlets, fewer full service grocery stores,[38] fewer recreational facilities, and in neighborhoods that are unsafe, restricting residents' ability to walk outside and children's opportunities for outside play.[39] Activity differences among SES subgroups have been attributed to difference in perceived benefits of being active, perceptions of desirable body shape, lack of time and financial resources for leisure time activities by lower income families and differences in real or perceived safety of neighborhoods.[40,41]

Various levels of SES may influence BMI and physical activity in a variety of ways either directly or indirectly, and in ways we did not measure. SES may serve as a proxy for other risks or exposures. At the family level SES may impact energy intake through foods purchased and available at the home. In addition, family resources impact transportation options and ability to pay fees related to recreational and sports opportunities that may provide access to vigorous, health enhancing forms of physical activity. Educational levels of parents/guardians and caregivers may influence nutrition and physical activity through knowledge about healthy choices. At the school level the percentage of students on free/reduced lunch may suggest a higher intake of fat (> 38%) found in school lunch and breakfast menus in which low income children are more likely to participate.[42] Low neighborhood SES may be a surrogate measure for poor access to healthy foods and high exposure to fast foods,[43] as well as increased exposure to crime[44] which may also limit outdoor recreational opportunities and "free play" in a particular neighborhood. Lower SES neighborhoods may also be less likely to have well maintained and safe parks, open spaces and playgrounds.[12,14]

These analyses begin to disentangle the complex SES, BMI and PA relationships and could provide initial support (or refute) the hypothesis that differences in opportunities to engage in particular behaviors and constraints (eg, time, transportation) on individual choice to engage in particular behaviors mediate or serve as "risk regulators"[24] in the effect of individual and neighborhood poverty on physical activity or BMI. While the impact SES was "independent" of race in the models some may argue that they are closely related however social and cultural factors should also be explored as this may explain additional influences.

Future work will focus on linking the multiple level objective neighborhood and family factors to health outcomes determining whether lower SES children are more exposed to these factors, and examining the potential for a dose-response relationship between these factors and physical activity levels and body weight status and adiposity in all children, regardless of SES.

There are policy and intervention implications related to the findings that physical activity opportunities are different depending on community SES level. Interventions need to consider both location and resources related to creating opportunities that are convenient and affordable to lower income adolescents.

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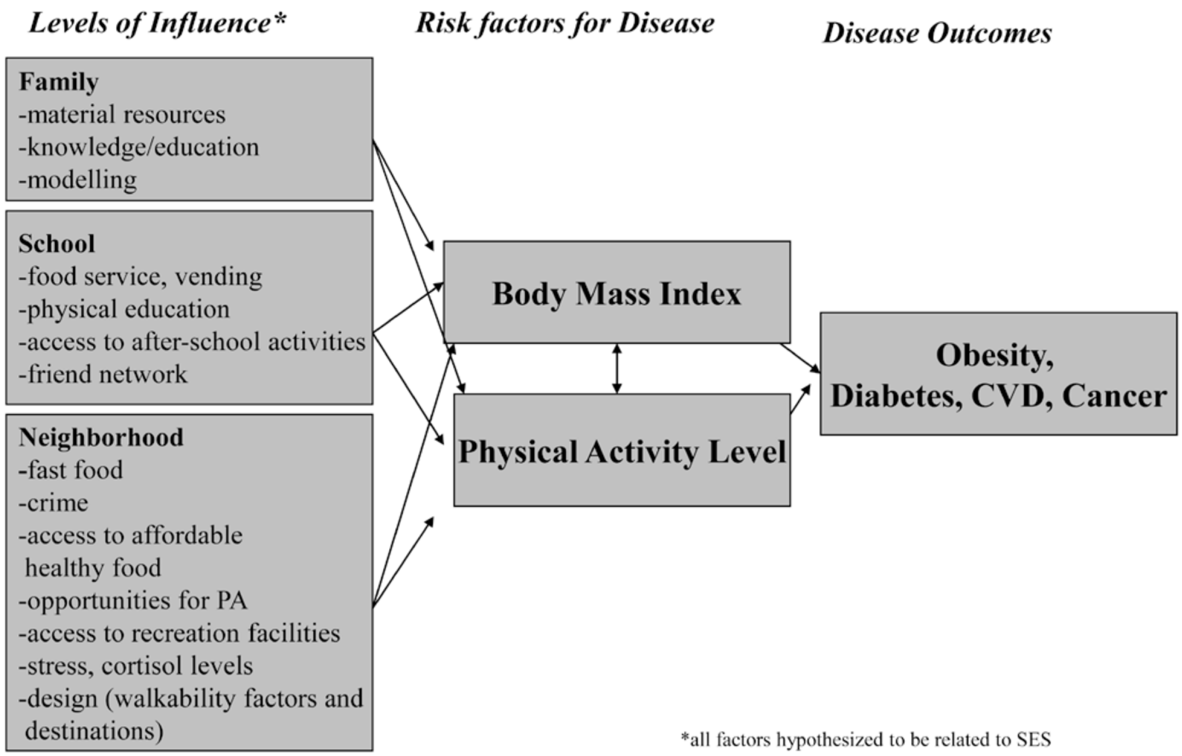

Figure 1.
Socioeconomic influences on weight and physical activity in adolescents.

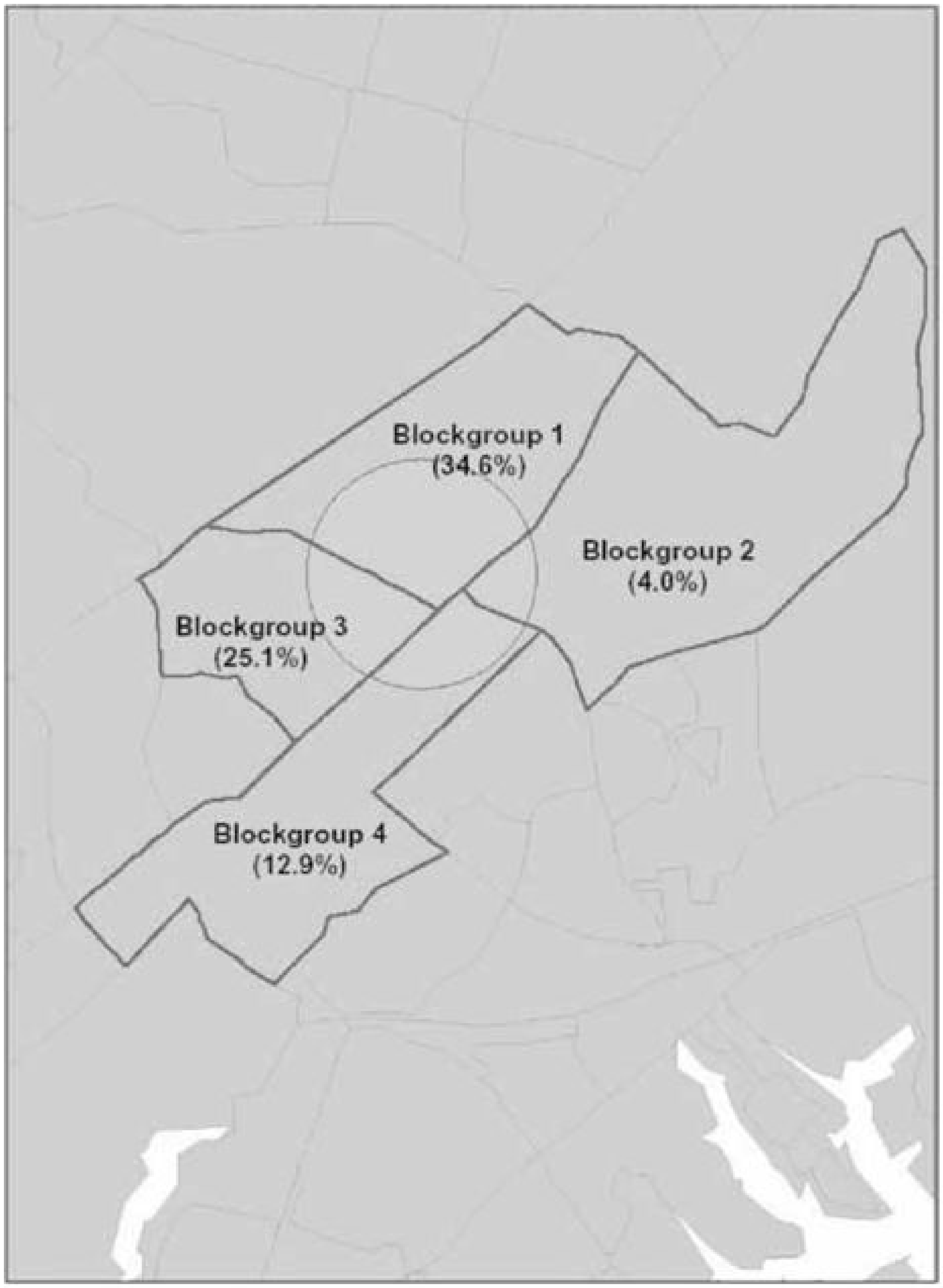

Figure 2.
SES calculation example; census blockgroups that intersect neighborhood. Numbers in parentheses represent % of area of blockgroup that falls within 1/2 mile circular neighborhood.

Table 1

Sociodemographic Characteristics of Girls in TAAG Study, n = 1554

	Mean (SD) or %	Range
Individual-level indicators of SES		
Highest parental education, %		NA
Mother or father		
Missing	30.0	
Less than high school	7.5	
High school	13.8	
Vocational school or some college	8.3	
College graduate	25.1	
Professional training beyond college	15.2	
Parental employment, %		NA
Missing	7.5	
Both unemployed	4.1	
One employed	30.2	
Both employed	58.2	
Free or reduced lunch (self- reported), %		NA
Don't know or missing	13.9	
Yes	41.2	
No	46.2	
Neighborhood-level indicators of SES		
School level % free or reduced lunch, mean (SD)	38 (26.9)	0, 91

Note. Neighborhood SES index = sum of four standardizing component measures.

Table 2

Relationship Between Individual and Neighborhood-Level SES and BMI, by Race and Overall Adjusted for Race

	White	**Black**	**Hispanic**	**Other**	**Overall***
Individual SES					
Parental education, %					
< High school	20.12	22.04	23.09 †	21.35 †	21.59 †
High school	19.72	22.79	21.41	21.13 †	21.10
Some College	20.29	22.88	21.60	20.42	21.30
College/College Plus	**19.69**	**22.05**	**21.27**	**19.02**	**20.66**
Missing	20.03	22.72	22.03	21.53‡	21.36‡
Parental employment					
Mother and father unemployed	19.35	22.51	21.86	23.04‡	21.30
One parent employed	19.68	22.00	22.16	20.41	20.92
Mother and father employed	**20.03**	**22.66**	**21.70**	**19.95**	**21.07**
Free or Reduced Lunch (self report)					
No	20.08	22.02	20.74‡	19.69‡	20.86

Note. Bold indicates base.

*Controlling for race.

†Statistically significant at the 0.10 level.

‡Statistically significant at the 0.05 level.

Table 3

Multivariate Relationship Between Individual and Neighborhood SES and BMI and Nonschool Physical Activity

	BMI		MET-minutes of MVPA	
	Estimate (SE)	***P*-value**	**Estimate (SE)**	***P*-value**
Intercept	19.6 (0.44)		681 (39.3)	
Highest parental education				
Missing	0.5 (0.32)	0.13	51.4 (28.1)	0.24
Less than high school	1.1 (0.50)		71.2 (44.3)	
High school	0.1 (0.39)		14.5 (34.6)	
Vocational school or some college	0.7 (0.47)		60.7 (41.9)	
College graduate	ref		ref	
Parental employment				
Mother and father unemployed	−0.3 (0.61)	0.60	−1.8 (54.0)	0.56
One parent employed	− 0.3 (0.27)		− 25.6 (24.1)	
Mother and father employed	ref		ref	
Free or reduced lunch (self-reported)				
Yes	0.1 (0.30)	0.72	−51.5 (26.8)	0.047
No	ref		ref	
Don't know/missing	−0.2 (0.39)		−70.8 (34.5)	
School-level % free or reduced lunch				
Change in outcome per 10% increase	0.1 (0.09)	0.36	3.0 (8.0)	0.70
Townsend Index				
Change in outcome per unit increase	0.1 (0.07)	0.16	5.6 (5.86)	0.34
Race/ethnicity				
White	ref	<0.001	ref	0.011
Black	1.7 (0.41)		−61.8 (36.4)	
Hispanic (of any race)	1.6 (0.37)		−98.2 (32.7)	
Other	−0.2 (0.43)		−89.0 (37.7)	
Model Concordance Correlation Coefficient	0.17		0.08	

Table 4

Comparison of Physical Activity Location[1] With Neighborhood Deprivation[2]

Location of physical activity	Total nonschool physical activity OR (95% CI)	Weekday after-school physical activity OR (95% CI)	Weekend physical activity OR (95% CI)
Home/neighborhood vs. school	1.49 (1.50, 4.14)	2.55 (1.48, 4.40)	2.30 (0.91, 5.80)
Home/neighborhood vs. community facility	1.68 (1.27, 2.23)	1.89 (1.15, 3.10)	1.52 (1.16, 2.00)
Home/neighborhood vs. other public facility	1.28 (0.74, 2.22)	1.68 (0.98, 2.88)	1.07 (0.50, 2.30)
Home/neighborhood vs. other	1.13 (0.63, 2.03)	2.21 (1.05, 4.65)	0.80 (0.36, 1.80)
Wald Chi-square (4 df) *P*-value for effect of neighborhood SES	<0.001	0.005	0.022

Note. OR (95% CI) bolded only when overall test of neighborhood SES is significant.

[1]Data derived from 3DPAR (3 day physical activity recall) corresponding with 30 minute blocks > 4.6 METS (MVPA).

[2]Based on values above vs. below the median value of the Townsend Index of Deprivation (high vs low deprivation).

Table 5

Odds Ratio (OR) and 95% Confidence Interval (CI) of Physical Activity Occurring as Part of an Organized Program, Class, or Team Based vs. Other Types of Activity for Girls Who Live in Neighborhoods of High vs. Low Deprivation*

Type of activity	Total non- school physical activity OR (95% CI)	Weekday after-school physical activity OR (95% CI)	Weekend physical activity OR (95% CI)
Organized program, class or team vs. school-based activity*	1.09 (0.58, 2.06)	1.05 (0.55, 2.00)	1.08 (0.29, 4.11)
Organized program, class or team vs. transportation-based activity**	0.48 (0.24, 0.93)	0.58 (0.32, 1.06)	0.38 (0.12, 1.16)
Organized program, class or team vs. work-based activity***	0.70 (0.34, 1.44)	0.34 (0.17, 0.69)	0.99 (0.40, 2.44)
Organized vs. unorganized program, class or team	0.85 (0.69, 1.06)	0.93 (0.71, 1.22)	0.79 (0.61, 1.04)
Wald Chi-square (4 df) *P*-value for effect of neighborhood SES	0.21	0.045	0.20

* School-based activities: club, student activity, marching band, physical education class.

** Transportation-based activity: riding in a car/bus, travel by walking, travel by bicycling.

*** Work-based activity: job, house chores, yard work.