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The Influence of Neighborhood Socioeconomic Status and Walkability on TV viewing time

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Abstract

Background—Influences on TV viewing time, which is associated with adverse health outcomes such as obesity and diabetes, need clarification.

Purpose—We assessed the relation of neighborhood socioeconomic status (SES) and walkability with TV viewing time in the Black Women's Health Study, a prospective study of African American women.

Methods—We created neighborhood SES and walkability scores using data from the U.S. census and other sources. We estimated odds ratios for TV viewing 5+ hours/day compared to 0–1 hours/day for quintiles of neighborhood SES and walkability scores.

Results—Neighborhood SES was inversely associated with TV viewing time. The odds ratio for watching 5+ hours/day in the highest compared to the lowest quintile of neighborhood SES was 0.66 (95% CI 0.54–0.81). Neighborhood walkability was not associated with TV viewing time.

Conclusions—Neighborhood SES should be considered in devising strategies to combat the high levels of sedentariness prevalent in African American women.

Keywords

TV viewing time; neighborhood factors; African American women

Both self-reported and objectively measured sedentariness (inactivity, often characterized by sitting) have been associated with obesity (1, 2), diabetes (2), and the metabolic syndrome (3), independent of physical activity. Sedentariness is not simply the converse of physical activity, since people may report both adequate levels of physical activity and high levels of sedentariness (4–6). Thus it is important to understand the factors that influence sedentary behavior as well as those that influence physical activity.

A large proportion of sedentary time during leisure hours is spent in television (TV) viewing (7): in the 2009 American Time Use Survey, women spent on average six hours per day on weekend days in leisure and sport activities, but 2.9 of those six hours were spent watching TV (8). Less than one hour was spent in sports, exercise, and recreation. TV viewing is a good marker of leisure time sedentariness, particularly in women (9), and itself has been

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associated with the risk of obesity (2, 10), the metabolic syndrome (11), and diabetes (10, 12, 13), independent of physical activity.

There is convincing evidence that characteristics of the neighborhood have an important influence on health (14, 15). For example, numerous studies have found neighborhood socioeconomic status (SES) and obesity to be inversely associated (16). The built environment has also been associated with health outcomes: residents of urban, pedestrian-friendly neighborhoods consistently report higher levels of physical activity (17) and lower levels of weight (18–20) than do residents of suburban, auto-oriented neighborhoods. Three studies have assessed neighborhood influences on sedentariness or TV viewing (21–23). Two studies reported inverse associations between neighborhood socioeconomic status (SES) and TV viewing (21, 22). One found an inverse association of walkability with TV viewing (22) while a second found a positive association (23).

We have previously shown in the Black Women's Health Study (BWHS) that neighborhood walkability (as indicated by housing density) is positively associated with time spent walking to a destination, though not with vigorous activity or walking for exercise (24). Furthermore, neighborhood walkability (25) and neighborhood SES (26) were inversely associated with weight gain and obesity incidence over six years of follow-up. The purpose of the present analysis was to assess the relation of neighborhood SES and walkability to TV viewing time.

Methods

The Black Women's Health Study (BWHS) is an ongoing, prospective follow-up study of African American women. The cohort was established in 1995, when approximately 59,000 African-American women aged 21 through 69 years were enrolled through questionnaires mailed to subscribers to Essence magazine, members of several professional organizations, and friends and relatives of early respondents. The cohort is followed biennially by mailed questionnaire and follow-up has averaged over 80% of the original cohort through six questionnaire cycles. The study was approved by the institutional review board of Boston University and all BWHS participants indicated informed consent.

The present analysis used data from the baseline questionnaire and from three subsequent follow-up cycles (1995–2001). We included 17,697 BWHS participants who lived in the New York, Chicago, or Los Angeles metropolitan regions at baseline in 1995 with complete data on TV viewing and height and weight at baseline, who did not report cancer over follow-up, did not report bariatric surgery, and whose addresses could be geocoded.

Ascertainment of TV viewing

At baseline in 1995, TV viewing was ascertained by the following question, "On average, during the past year, how many hours each day did you spent watching television?" with five response categories (none, <1 hour, 1–2 hours, 3–4 hours, 5 or more hours). In 1997 the question was modified to ascertain time spent "watching TV or videos" and in 1999 it was modified to ascertain "watching TV, videos, home computer".

Assessment of neighborhood factors

BWHS participants were linked to the year 2000 US Census block groups based on the addresses reported on each questionnaire from 1995–1999 in order to calculate a neighborhood SES score. Based on factor analysis with varimax rotation, six variables were selected to represent neighborhood SES from among 29 block group census variables measuring dimensions of education, income, and wealth: median household income; median housing value; % households receiving interest, dividends, or net rental income; % adults

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aged ≥25 that have completed college; % employed persons aged ≥16 in white collar occupations; and % of families with children not headed by a single female. Regression coefficients from the factor analysis were used to weight the variables for a combined neighborhood score, with higher scores representing higher neighborhood SES.

Urban form factors were quantified within the ½ mile network buffer around each participant's residential location using aerial photography, road network files, the 2000 US Census, and transit maps using geographic information systems. The following aspects of urban form were quantified as detailed previously (24): density, quantified by net housing density (units/acre); interconnectedness of streets, quantified by average block size, intersection density, and ratio of 4-way to total intersections; accessibility of public transit, quantified by shortest distance from each participant residence to a subway, train, or ferry stop and length of bus routes within the ½-mile buffer; and percent of streets with sidewalk coverage. Factor analysis with varimax rotation was used to combine the urban form variables into a score that represents "walkability". Regression coefficients from the factor analysis were used to weight the variables for a combined neighborhood walkability score, with higher scores representing more urban, dense, and walkable neighborhoods.

Covariates

Data on age, parity, smoking history, alcohol consumption, and presence of chronic disease were first obtained in 1995 and updated on all subsequent questionnaire cycles. Marital status, prior cancer, caregiver responsibilities, and years of education were obtained at baseline in 1995. The 1995 questionnaire included a modification of the 68-item Block NCI food frequency questionnaire (27) that assessed the consumption of specified foods during the previous year, from which we estimated total daily energy intake.

Statistical analysis

We estimated the odds ratios for heavy TV viewing (5+ hours per week) compared to light TV viewing (0–1 hours per week) for quintiles of neighborhood SES and walkability using a repeated measures Generalized Estimating Equation (GEE) model. The reference group was the first quintile of the SES or walkability score (lowest level of SES or walkability). Models were adjusted for age; calendar time; study area; years of education; cigarette smoking; alcohol consumption; marital status; hours/week of vigorous exercise; hours/week walking for exercise; hours per week walking for transport; body mass index (BMI; weight in kg divided by height squared in meters); presence of chronic disease; and energy intake (kcal/day). All variables were time-varying with the exception of marital status, caregiver responsibilities, years of education, and energy intake, which were ascertained at baseline. Energy intake of respondents with total daily energy intake of <500 kg/day or >3800 kg/day was coded as missing.

We present results from separate models: First, neighborhood SES and walkability were assessed in separate models, with all covariates (model 1). Then, both neighborhood factors were included in the same model, with all covariates (model 2). We repeated model 2 within strata of age, city, years of education, level of physical activity, walking for exercise, walking for transport, and questionnaire cycle. We tested for interaction by assessing the chi-square values associated with cross product terms for the neighborhood factors and the stratified variables.

Results

The distribution of TV viewing among BWHS participants at baseline in 1995 was 0–1 hour/day, 9.7% (n=1711); 1–2 hours/day, 37.1% (n=6561); 3–4 hours/day, 37.4% (n=6615);

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and 5+ hours/day, 15.9% (n=2810). In 1997, when the question was modified to include "videos", the distribution of TV viewing shifted slightly upwards, with 7.4% reporting 0–1 hours/day, 34.7% reporting 1–2 hours/day, 38.3% reporting 3–4 hours/day, and 19.5% reporting 5+ hours/day. The distribution in 1999, when the query specified "videos and home computer", was almost identical to that in 1997.

As shown in table 1, compared to women living in the lowest quintile of neighborhood walkability, women in the highest quintile were younger, had higher energy intake and fewer years of education, and were more likely to be married, be current smokers, and walk for transport. Compared to women living in the lowest quintile of neighborhood SES, women in the highest quintile were older, had lower BMI and energy intake, had more years of education, and were more likely to be married and to participate in vigorous activity and walking for exercise. They were less likely to smoke, walk for transport, or report a chronic disease.

In model 1, the odds ratios for heavy TV viewing were 1.22 and 1.25 for the two highest quintiles of neighborhood walkability relative to the lowest quintile (Table 2). When neighborhood SES was added to model 2, both odds ratios were reduced to 1.04. Neighborhood SES was inversely associated with heavy TV viewing with and without adjustment for neighborhood walkability, and tests for linear trends were significant in both models: in model 2, the odds ratio for the highest quintile of SES was 0.66 (95% CI 0.54–0.81).

Odds ratios from model 2 associated with the walkability and SES scores did not differ significantly by strata of age, city, years of education, or hours/week of walking for transport (data not shown). The effect of neighborhood SES on TV viewing was more pronounced among those who reported <3 hrs/week of vigorous physical activity (OR for 5th compared to 1st quintile of SES= 0.65, 95% CI 0.52–0.80) than those who reported 3+hours/week (OR=0.81, 95% CI 0.54–1.20), although the odds ratios did not differ in a statistically significant way (p for interaction =0.80).

When the analysis was confined to the 45% of women with consistent TV viewing habits (the same level of TV viewing reported on all questionnaires), results were similar to those from the full cohort. Estimates were also similar within strata of questionnaire cycle (1995–1997, 1997–1999, 1999–2001) (data not shown).

Discussion

In this large population of African American women, neighborhood SES was inversely associated with TV viewing, independent of individual SES and levels of physical activity. Neighborhood walkability was not associated with TV viewing; a preliminary association was due to the confounding effect of neighborhood SES.

The association between neighborhood SES and TV viewing observed in the present study is consistent with findings from two of the three studies that have assessed the association (21–23). In studies from Australia and Scotland, residents of low-SES neighborhoods reported watching TV for on average 28 and 23 more minutes per day, respectively, than residents of high SES neighborhoods (21, 22). In contrast, in a Belgian study, neither self-reported nor accelerometer-measured daily sitting time was associated with neighborhood SES (23). The three studies adjusted for individual SES and physical activity, among other factors. The Australian (22) and Belgian (23) studies also assessed neighborhood walkability using methods similar to those in the present study. Their results were conflicting. In the Australian study, TV viewing time was inversely associated with neighborhood walkability among women (though not in men): women in the highest level of walkability watched TV

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on average 27 minutes less per day than residents of neighborhoods of low walkability (22). In the Belgian study, neighborhood walkability was positively associated with self-reported and accelerometer-measured sitting time (36 minutes more in neighborhoods of high compared to low walkability for both measures) (23). The discrepancies in the study findings may be explained in part by the fact that in the Australian study the outcome was TV viewing time only whereas in the Belgian study it was all sedentary time, including at work.

The present study relied on self-reported TV and other screen viewing time. Test-retest reliabilities of self-reported TV viewing time have been found to be moderate to high (28). In one validation study wherein self-reported TV-viewing time was compared to time ascertained by an electronic TV monitor, there was a significant positive correlation between the two measures (Spearman's $r = 0.54$, $p<0.001$) (29). In that study, the average subject underestimated TV viewing by 36 minutes/day; when subjects who reported that they often have the TV on in the background without actively watching were excluded, the average subject underestimated TV viewing time by only 12 minutes/day.

In the present study the question about TV viewing was slightly modified from year to year. However, associations between neighborhood walkability and SES were similar within each two-year questionnaire cycle. Furthermore, results from analyses confined to women who reported the same level of TV viewing on each questionnaire were similar to the overall results.

A strength of our study is the assessment of African American women, who have been understudied in regard to the built environment. Other strengths are the large size of the cohort, and that participants lived in three major metropolitan areas which included a range of neighborhood types, from disadvantaged to wealthy and from low-density suburban to dense urban core. We controlled for a range of potential confounders including indicators of individual SES and behaviors related to TV viewing.

In conclusion, we found an inverse association between neighborhood SES and TV viewing in a large cohort of African American women, even among women with high levels of education. We found no association between neighborhood walkability and TV viewing. The present findings add to the evidence that neighborhood SES influences health and health behaviors independent of individual SES (14, 15, 30). Thus it is crucial to consider neighborhood SES in devising strategies to combat the high levels of sedentariness prevalent in African American women (31, 32).

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Table 1

Characteristics in the lowest and highest quintiles of walkability and neighborhood SES scores, BWHS 1995[a]

	Neighborhood walkability score		Neighborhood SES	
	Quintile 1 (least urban)	**Quintile 5 (most urban)**	**Quintile 1 (lowest)**	**Quintile 5 (highest**
Mean (SD) of characteristic				
Age (years)	40.1 (10.9)	37.3 (11.1)	38.4 (11.3)	40.0 (10.7)
BMI	27.2 (6.0)	27.5 (6.3)	29.4 (6.8)	26.8 (5.8)
Energy intake (kcal)	1549 (680)	1619 (693)	1679 (741)	1526 (647)
% with characteristic				
Education (≥16 years)	53.7	47.2	28.4	65.2
Married/living as married	25.9	47.5	28.2	48.8
≥1 hr/wk vigorous activity	40.6	40.9	32.2	44.1
≥1 hr/wk walking for exercise	58.6	57.8	54.3	60.0
≥1 hr/wk walking for transport	28.6	70.4	56.3	37.6
Current smoker	12.6	19.1	24.1	11.4
Current drinker	28.9	30.2	30.2	30.9
Presence of chronic disease	8.0	7.7	11.8	6.4

[a]The data are shown for extreme categories of neighborhood walkability and SES.

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Table 2

Odds of TV viewing 5+ hours/day compared to 0–1 hour/day by quintile of neighborhood walkability and neighborhood SES

Neighborhood Factors (Quintiles)	N viewing 5+ hrs per day/ N in quintile[a]	Model 1: neighborhood factors in model individually	Model 2: neighborhood factors in model together
		OR[b] (95% CI)	OR[b] (95% CI)
Walkability score			
1	1353/8834	ref	ref
2	1450/8940	1.05 (0.89–1.24)	0.96 (0.81–1.15)
3	1605/8715	1.17 (0.98–1.39)	1.02 (0.85–1.22)
4	703/9125	1.22 (1.02–1.45)	1.04 (0.86–1.25)
5	667/8760	1.25 (1.04–1.51)	1.04 (0.85–1.27)
p_{trend}		0.01	0.96
SES score			
1	2102/8672	ref	ref
2	1714/8738	0.87 (0.73–1.03)	0.87 (0.73–1.04)
3	1537/8848	0.84 (0.70–1.00)	0.85 (0.71–1.03)
4	1330/8813	0.71 (0.59–0.85)	0.72 (0.60–0.87)
5	1213/8802	0.65 (0.54–0.78)	0.66 (0.54–0.81)
p_{trend}		<.0001	0.0002

[a] Number of observations, not individuals.

[b] Adjusted for age (continuous); calendar time (1995–1997, 1997–1999, 1999–2001); city (New York, Chicago, Los Angeles); years of education (<12, 12, 13–15, 16, 17+); cigarette smoking (current, ex, never; alcohol consumption (current, ex, never); marital status (married/living as married, single, widowed/divorced/separated); hours/week of vigorous exercise (<5, 5+); walking for exercise (<5, 5+); walking for transport (<5, 5+);BMI (<25, 25–29, 30–34, 35+); presence of chronic disease (yes,no); and energy intake (kcal/day) (quintiles).