The Contextual Effect of the Local Food Environment on Residents' Diets: The Atherosclerosis Risk in Communities Study

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The relationship between diet and disease is well established. Research linking dietary intake to cancer,[1–4] diabetes,[5] hypertension,[6,7] birth defects,[8,9] and heart disease[4,10–12] has led to dietary change recommendations. For instance, in 1961, the American Heart Association recommended a reduction in total fat, saturated fat, and cholesterol and an increase in polyunsaturated fats for Americans' diets.[13] Currently, the American Cancer Society, the American Dietetic Association, the American Academy of Pediatrics, the National Institutes of Health, and the American Heart Association recommend a healthy eating program based on the Department of Agriculture's Food Guide Pyramid.[14,15]

Although recommendations for dietary modifications have spanned more than 4 decades, many intervention trials have had difficulty producing sustainable dietary changes.[16–18] Researchers have found that dietary choices are influenced by a variety of factors, including knowledge of the causative and preventive effects of certain foods, the cost of food, and the availability of different foods. For instance, the change in US regulatory policy in 1985, allowing producers to advertise the relationship between food products and health, has led to improvements in food choices for some individuals.[19,20] Similarly, researchers have found that improving knowledge of the relationship between diet and health influences food choices.[21,22] In addition to specific knowledge of the relationship between diet and health, educational attainment is associated with dietary choices.[23,24]

As well as knowledge, the affordability of food has been documented as a factor influencing people's diets. For instance, research suggests that even when receiving combined aid from Food Stamps, Aid to Families with Dependent Children, and Supplemental Security Income, some people have not been able

Objectives. We studied the association between the local food environment and residents' report of recommended dietary intake.

Methods. Recommended intakes of foods and nutrients for 10 623 Atherosclerosis Risk in Communities participants were estimated from food frequency questionnaires. Supermarkets, grocery stores, and full-service and fast-food restaurants were geocoded to census tracts.

Results. Black Americans' fruit and vegetable intake increased by 32% for each additional supermarket in the census tract (relative risk [RR]=1.32; 95% confidence interval [CI]=1.08, 1.60). White Americans' fruit and vegetable intake increased by 11% with the presence of 1 or more supermarket (RR=1.11; 95% CI=0.93, 1.32).

Conclusions. These findings suggest the local food environment is associated with residents' recommended diets. (*Am J Public Health.* 2002;92:1761–1767)

to meet their nutritional needs.[25] These authors speculate that the migration of supermarkets to the suburbs and a lack of transportation contribute to the malnutrition experienced by low-income Americans. In addition, foods recommended by health authorities are sometimes more expensive and less available in poor areas[26–29] and, although people with low incomes spend less money, a greater proportion of their income is spent on food.[30,31] Furthermore, current research shows a lower prevalence of supermarkets and a higher prevalence of independently owned grocery stores in low-wealth and predominately Black neighborhoods and a greater proportion of households without access to private transportation in these neighborhoods.[32]

The impact that the availability of healthy foods has on people's diets has received somewhat less attention. Alcohol research suggests that alcoholic beverage consumption increases with an increase in the availability of alcohol[33–35]; however, fewer studies have researched whether the availability of recommended foods affects their consumption.[36]

This study measured the association between the physical availability of food stores and food service places and people's adherence to health authorities' recommendations

for a healthy diet. The following 4 indicators of a "healthy diet" have been selected because of their causative or preventive relationship with disease and consistent recommendations from health authorities: (1) servings of fruits and vegetables per day, (2) percentage of calories from fat, (3) saturated fat, and (4) dietary cholesterol. The Atherosclerosis Risk in Communities (ARIC) study has been selected for this analysis because (a) these data have already been collected for a large population-based sample with extensive information on dietary intake, (b) the geographic area from which the ARIC population was sampled is diverse with respect to the wealth and racial makeup of residential census tracts, (c) the ARIC participants are heterogeneous in terms of race, income, and education (all characteristics known to be associated with dietary intake), and (d) neighborhood differences in diet have been found for these community members.[37]

There are both clinical and public health benefits to understanding how the local environment may influence food choices. From a clinical perspective, it is important to know whether the dietary guidelines being prescribed are actually achievable. Clinicians may need to take into account the local food environment when prescribing dietary modifi-

cations. The benefit to public health is the opportunity to intervene at an environmental level, while still educating people about the relationship between diet and disease. The difficulty in changing dietary behavior may stem from the environmental factors that either reduce people's motivation to adopt a healthy diet or make changes difficult or impossible to achieve. These limitations may stem from the characteristics of one's local food environment.

METHODS

The Local Food Environment

1990 census tracts were used as approximations of neighborhoods, and the local food environment was characterized by the number and types of food stores and food service places located in the census tract where a participant lived.[38] Of the 221 census tracts used, 29 were located in Washington County, Maryland, 80 in Forsyth County, North Carolina, 58 in Jackson City, Mississippi, and 54 in the following suburbs of Minneapolis, Minnesota: Brooklyn Center, Brooklyn Park, Crystal, Golden Valley, New Hope, Plymouth, and Robbinsdale. Five tracts were excluded because they contained 10 or fewer housing units and 8 because they had no ARIC participants or because ARIC participants were excluded, leaving 208 tracts available for analysis (Maryland=28, North Carolina=78, Mississippi=48, Minnesota=54).

Names and addresses of food stores and food service places for each of the 4 communities were collected in 1999 from the local health departments and state departments of agriculture. A commercial firm carried out the geocoding using 2 methods. Seventy-five percent of business addresses were linked to census tracts by exact address matching, and the remainder was estimated from zip code centroids.[39]

Food stores and food service places were assigned an industry code based on the 1997 North America Industry Classification System (NAICS). Food stores are defined as industries that retail food and beverage merchandise from fixed point-of-sale locations, including supermarkets, grocery stores, convenience stores, and specialty food stores. Supermarkets have a larger selection of healthy food[40]

at lower prices[41]; therefore, these large corporate-owned "chain" stores are distinguished from small locally owned grocery stores. Food service places are defined as industries that prepare meals, snacks, and beverages by customer order for immediate on-premises and off-premises consumption; they include full-service restaurants, limited-service eating places, and bars and taverns. Limited-service eating places include franchised fast-food restaurants and other restaurants serving over-the-counter meals and snacks. A full description of the NAICS codes and methods for assigning these codes has been described elsewhere.[32,42]

Supermarkets and grocery stores sell 92% of the volume of annual sales of all food and beverage stores in the United States.[43] Furthermore, full-service and limited-service restaurants sell 82% of the volume of sales of all food service and drinking places.[44] Therefore, food stores and food service places other than supermarkets, grocery stores, full-service restaurants, and fast-food restaurants were investigated only as covariates, since their contributions to people's local food environments are negligible.

ARIC Participants

Of the 12 887 residential addresses of people who participated in the ARIC study's third visit (1993–1995), 11 771 (91%) were geocoded to census tracts by exact address matching. An additional 1109 addresses were estimated from zip code centroids. A total of 1147 addresses were excluded because participants had moved out of the ARIC-defined geographic areas or the census tract was excluded. An additional 448 people were excluded because their dietary data were considered invalid owing to missing data or improbable total energy intake, and 630 people were excluded owing to missing values for income. Finally, 32 people of other race groups were excluded because their food–environment relationship may be unlike that of Black or White Americans. A full description of the ARIC participants has been reported previously.[45]

Dietary Intake

A semiquantitative food frequency questionnaire was administered to ARIC participants from 1993 through 1995. Daily ser-

vings of fruit were calculated by summing the weighted servings of apples, pears, oranges, orange juice, grapefruit juice, peaches, apricots, plums, bananas, and other fruits. Daily servings of vegetables were calculated by summing weighted servings of string or green beans, broccoli, cabbage, cauliflower, brussels sprouts, carrots, corn, collard greens, lima beans, lentils, spinach, peas, squash, sweet potatoes, beans, and tomatoes. The following weights were used: "almost never"=0, "1–3 per month"=0.066, "1 per week"=0.14, "2–4 per week"=0.43, "5–6 per week"= 0.79, "1 per day"=1, "2–3 per day"=2.5, "4–6 per day"=5, "more than 6 per day"=7. Daily intake of cholesterol (in milligrams) and percentage of calories from fat and saturated fat were computed according to methods developed by Willett et al. on the basis of data from the US Department of Agriculture.[46]

A healthy diet was defined for individuals as one meeting the US Department of Agriculture and the US Department of Health and Human Services Dietary Guidelines for Americans: (a) at least 2 servings of fruit and at least 3 servings of vegetables per day, (b) 30% or less of calories from total fat, (c) less than 10% of calories from saturated fat, and (d) 300 or fewer milligrams of dietary cholesterol per day.[15,47,48]

Statistical Methods

Random-effects log-linear models with a random intercept for each census tract were used to obtain relative risks of the association between fulfilling dietary guidelines and the presence of specific food establishments.[49] The number of stores of each type was first evaluated in multiple categories. Where linear relationships were observed, a single parameter was estimated for the change in risk of meeting dietary recommendations for each additional food store of that type in the census tract.

Models were stratified by race, and 2 series of adjusted models were then calculated for each racial group. The first adjusted model included terms for all types of food stores and food service places to reflect the fact that people's local food environments are composed of a variety of food stores and restaurants. Because education and income are associated with both diet and where people live, the sec-

ond adjusted model included education and income in addition to food stores and food service places. Food stores and food service places were dichotomized as any vs none of a particular kind, and people with 12 years of education or more were compared with people with less than 12 years of education. Annual family income was categorized as follows: less than $5000, $5000 to $7999, $8000 to $11 999, $12 000 to $15 999, $16 000 to 24 999, $25 000 to $34 999, $35 000 to 39 999, and $40 000 to $49 999; people in these categories were compared with people with incomes of $50 000 or more. Age had very little influence on the association between the local food environment and residents' reported diets; therefore, adjustment for age was not made. Finally because recommended intake of these foods and nutrients are made independent of caloric intake, adjustment for calories was not made in any of the analyses.

RESULTS

Demographic and dietary characteristics of the Black and White participants are presented in Table 1. There were 2392 Black Americans living in 110 of the 208 census tracts (Maryland=8; Minnesota=7; Mississippi=48; North Carolina=47) and 8231 White Americans living in 151 of the 208 census tracts (Maryland=28; Minnesota=54; North Carolina=69). More women than men of both race groups participated. White Americans had a higher mean level of education than Black Americans. The age of the participants was roughly the same for the 2 race groups.

Reported dietary intake of total fat and saturated fat were similar for Black and White Americans, but fruit, vegetable, and cholesterol intake was higher for Black Americans. The proportion of Americans that ate at least 2 fruits and at least 3 vegetables per day was low, although more Black Americans reported meeting this dietary recommendation. In addition, more Black Americans met the recommendations for saturated fat. Conversely, more White Americans met recommendations for cholesterol.

There were fewer supermarkets than any of the other types of food establishment for both groups; however, 5 times more supermarkets were located in census tracts where White Americans resided. Neighborhoods where White Americans resided contained more full-service restaurants but fewer grocery stores. Fast-food restaurants were fairly evenly dispersed across neighborhoods.

Black Americans

Only 8% of Black Americans lived in a census tract with at least one supermarket. Nevertheless, the presence of supermarkets was associated with meeting dietary recommendations among Black Americans. For instance, even after control for education and income, a higher proportion of Black Americans living in census tracts with at least one supermarket reported meeting dietary guidelines for fruits and vegetables than did Black Americans living in census tracts with no supermarkets (Table 2). Among Black Americans living in census tracts with supermarkets, a dose–response pattern was apparent: Black Americans reported increased intake of fruits and vegetables when there was one supermarket in their census tract (relative risk [RR]=1.30; 95% confidence interval [95% CI]=0.93, 1.81) and a larger increase when there were 2 or more supermarkets (RR=2.18; 95% CI= 1.57, 3.03), corresponding to an average increase of 32% for each additional supermarket (linear RR=1.32; 95% CI=1.08,1.60). After adjustment for the other types of food stores and food service places, the linear association increased and precision decreased only moderately (linear RR=1.41; 95% CI=1.13, 1.77). When education and income were added to the model, the effect the presence of supermarkets had on reported dietary intake of fruits and vegetables did not change (linear RR=1.41; 95% CI=1.13,1.76).

The proportion of meeting dietary recommendations for total fat was about 25% higher among Black Americans living in a census tract with at least one supermarket (RR=1.27; 95% CI=1.09, 1.49), with a 4% change after adjustments (Table 2). The presence of at least one supermarket was associated with a 38% increase in reported intake of recommended levels of saturated fat for Black Americans (RR=1.38; 95% CI=1.15, 1.65), with a 6% change after adjustments (Table 2), and with a small decrease in reported intake of recommended levels of cholesterol (RR=0.93; 95% CI=0.84, 1.04).

TABLE 1—Characteristics of Individuals and Local Food Environments, by Race of Participants: The Atherosclerosis Risk in Communities Study

	Black Americans (n = 2392)	White Americans (n = 8231)
Characteristic		
Female, %	64.1	53.5
Years of education, mean (SD)	13.6 (5.1)	14.6 (4.1)
Age (y), mean (SD)	59.0 (5.7)	60.4 (5.7)
Dietary intake		
Fruits and vegetables (servings/day), mean (SD)	4.5 (3.1)	4.0 (2.3)
Total fat (g), mean (SD)	55.7 (26.1)	55.5 (26.2)
Saturated fat (g), mean (SD)	19.8 (10.0)	20.4 (10.3)
Cholesterol (g), mean (SD)	264.7 (149.2)	215.1 (114.1)
Percentage meeting recommended intake of—		
Fruits and vegetables	14.8	8.2
Total fat	43.9	42.3
Saturated fat	36.9	32.0
Cholesterol	68.7	82.4
No. of food stores and food service places		
Supermarkets, mean (SD)	0.1 (0.4)	0.5 (1.1)
Grocery stores, mean (SD)	1.5 (1.5)	0.6 (0.9)
Full-service restaurants, mean (SD)	3.3 (3.6)	4.1 (5.0)
Fast-food restaurants, mean (SD)	2.1 (2.7)	1.9 (2.8)

TABLE 2—Unadjusted and Adjusted Relative Risks (RRs) and 95% Confidence Intervals (CIs) of Meeting Dietary Guidelines of Foods and Nutrients by Presence of Supermarkets, Grocery Stores, and Full-Service and Fast-Food Restaurants in the Census Tract of Residence: Black Americans (n = 2392) in the Atherosclerosis Risk in Communities Study

	Supermarkets (Any = 202)		Grocery Stores (Any = 1738)		Full-Service Restaurants (Any = 1889)		Fast-Food Restaurants (Any = 1416)	
	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI
Fruits and vegetables								
Model 1[a]	1.42	(1.06, 1.91)	0.99	(0.80,1.23)	1.12	(0.87, 1.43)	1.02	(0.84, 1.25)
Model 2[b]	1.53	(1.11, 2.21)	1.06	(0.83, 1.36)	1.08	(0.81, 1.45)	0.97	(0.76, 1.25)
Model 3[c]	1.54	(1.11, 2.12)	1.07	(0.83, 1.38)	1.06	(0.79, 1.41)	0.94	(0.74, 1.21)
Total fat								
Model 1[a]	1.27	(1.09, 1.49)	0.97	(0.85, 1.09)	1.10	(0.95, 1.27)	1.01	(0.90, 1.14)
Model 2[d]	1.24	(1.04, 1.48)	1.04	(0.90, 1.19)	1.10	(0.93, 1.30)	0.99	(0.86, 1.14)
Model 3[e]	1.22	(1.03, 1.44)	1.06	(0.92, 1.21)	1.07	(0.91, 1.25)	0.98	(0.86, 1.13)
Saturated fat								
Model 1[a]	1.38	(1.15, 1.65)	0.92	(0.80, 1.07)	1.26	(0.95, 1.27)	1.01	(0.90, 1.14)
Model 2[b]	1.31	(1.08, 1.60)	0.99	(0.84, 1.15)	1.25	(1.03, 1.51)	0.96	(0.81, 1.12)
Model 3[c]	1.30	(1.07, 1.56)	1.03	(0.88, 1.20)	1.21	(1.01, 1.46)	0.94	(0.81, 1.10)
Cholesterol								
Model 1[a]	0.93	(0.84, 1.04)	0.98	(0.92, 1.05)	1.04	(0.97, 1.12)	0.96	(0.90, 1.02)
Model 2[b]	0.94	(0.83, 1.06)	1.00	(0.93, 1.08)	1.05	(0.96, 1.14)	0.97	(0.90, 1.05)
Model 3[c]	0.94	(0.84, 1.05)	1.01	(0.94, 1.08)	1.05	(0.96, 1.13)	0.97	(0.90, 1.04)

Note. Relative risks are for meeting dietary guidelines of foods and nutrients when any of the specified type of store or restaurant is present in the respondent's census tract vs when none is present.
[a]Unadjusted relative risk.
[b]Adjusted for other types of food stores and food service places.
[c]Adjusted for other types of food stores, food service places, income, and education.
[d]Adjusted for other types of food stores and food service places except convenience stores because models 2 and 3 for Total Fat did not converge.
[e]Adjusted for income, education, and other types of food stores and food service places except convenience stores because models 2 and 3 for Total Fat did not converge.

Although 73% of Black Americans lived in areas with a small grocery store, their presence showed little association with the reported diets of Black Americans. Parameter estimates of the association between grocery stores and healthy eating were close to the null and confidence intervals were narrow. Adjustments affected the relative risks and confidence intervals very little (Table 2).

Most Black Americans (79%) lived in areas with full-service restaurants. The presence of this type of food service place was more strongly associated with residents' intake of saturated fat than with other recommendations. Compared with Black respondents living in areas without full-service restaurants, those living in neighborhoods with at least one full-service restaurant reported a 26% increase in meeting the recommended diet for saturated fat, which was largely unaffected by additional adjustments (RR=1.26; 95% CI=0.95, 1.27).

Nearly 60% of Black respondents lived in neighborhoods with at least one fast-food restaurant; however, small parameter estimates and narrow confidence intervals indicated that there was little association between the presence of fast-food restaurants and reported dietary intake of recommended foods and nutrients (Table 2).

White Americans

Thirty-one percent of White respondents lived in a census tract with at least one supermarket, 42% lived in census tracts with at least one grocery store, 80% lived in census tracts with at least one full-service restaurant, and 55% lived in census tracts with at least one fast-food restaurant. Compared with Black Americans, on average, estimates of the association between the local food environment and reported intake of recommended foods and nutrients revealed associations that

were weaker, and linear associations were not observed (Table 3). In only 3 cases did the associations between meeting dietary recommendations differ by 10% or more when food establishment categories were compared: the presence of at least one supermarket was associated with an 11% increase in meeting dietary requirements for fruits and vegetables (RR=1.11; 95% CI=0.93, 1.32) and a 10% increase in meeting requirements for saturated fat, after adjustments (RR=1.10; 95% CI=1.00, 1.22), and the presence of fast-food restaurants was associated with a 12% increase in meeting fruit and vegetable requirements after adjustment for other covariates (RR=1.12; 95% CI=0.91, 1.37).

DISCUSSION

Results of this study show some associations between the local food environment and

TABLE 3—Unadjusted and Adjusted Relative Risks (RRs) and 95% Confidence Intervals (CIs) of Meeting Dietary Guidelines of Foods and Nutrients by Presence of Supermarkets, Grocery Stores, and Full-Service and Fast-Food Restaurants in the Census Tract of Residence: White Americans (n = 8231) in the Atherosclerosis Risk in Communities Study

	Supermarkets (Any = 2572)		Grocery Stores (Any = 3475)		Full-Service Restaurants (Any = 6573)		Fast-Food Restaurants (Any = 4564)	
	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI
Fruits and vegetables								
Model 1[a]	1.11	(0.93, 1.32)	0.92	(0.78, 1.09)	0.97	(0.80, 1.18)	1.06	(0.90, 1.24)
Model 2[b]	1.08	(0.90, 1.31)	0.93	(0.78, 1.10)	0.94	(0.75, 1.19)	1.12	(0.91, 1.37)
Model 3[c]	1.08	(0.89, 1.30)	0.93	(0.78, 1.10)	0.94	(0.75, 1.19)	1.12	(0.91, 1.37)
Total fat								
Model 1[a]	1.07	(1.00, 1.15)	0.97	(0.91, 1.04)	0.97	(0.90, 1.05)	1.00	(0.94, 1.07)
Model 2[d]	1.09	(1.01, 1.19)	0.96	(0.90, 1.04)	0.94	(0.86, 1.04)	1.01	(0.91, 1.07)
Model 3[e]	1.09	(1.01, 1.18)	0.97	(0.90, 1.04)	0.95	(0.87, 1.05)	0.99	(0.91, 1.08)
Saturated fat								
Model 1[a]	1.08	(0.99, 1.17)	0.93	(0.86, 1.01)	1.00	(0.90, 1.10)	1.00	(0.92, 1.09)
Model 2[b]	1.10	(1.00, 1.22)	0.91	(0.83, 0.99)	1.01	(0.90, 1.14)	0.96	(0.86, 1.06)
Model 3[c]	1.09	(0.99, 1.20)	0.92	(0.84, 1.00)	1.03	(0.91, 1.15)	0.95	(0.86, 1.05)
Cholesterol								
Model 1[a]	1.00	(0.98, 1.02)	0.98	(0.96, 1.00)	1.00	(0.97, 1.02)	0.99	(0.97, 1.01)
Model 2[b]	1.00	(0.98, 1.02)	0.98	(0.96, 1.01)	1.01	(0.98, 1.04)	0.99	(0.96, 1.01)
Model 3[c]	1.00	(0.97, 1.02)	0.99	(0.97, 1.01)	1.02	(0.99, 1.04)	0.98	(0.96, 1.01)

Note. Relative risks are for meeting dietary guidelines of foods and nutrients when 1 or more store or restaurant of the specified type is present in the respondent's census tract vs when none is present.
[a]Unadjusted relative risk.
[b]Adjusted for other types of food stores and food service places.
[c]Adjusted for other types of food stores, food service places, income, and education.
[d]Adjusted for other types of food stores and food service places with the exception of convenience stores, because models 2 and 3 for Total Fat did not converge.
[e]Adjusted for income, education, and other types of food stores and food service places with the exception of convenience stores, because models 2 and 3 for Total Fat did not converge.

residents' reports of meeting dietary recommendations. Black Americans living in areas with supermarkets have healthier diets in terms of fruits and vegetables, total fat, and saturated fat. We also observed that Black Americans living in neighborhoods with full-service restaurants had healthier diets in terms of saturated fat. These observations were less pronounced for White Americans. Although the risk ratios for supermarkets are in the same direction for the same indicators of healthy eating, the magnitudes of effects were not as great.

Adjustment for other covariates resulted in very little change (<10%) in the magnitude of the effects or the width of the confidence intervals. Once other food stores were controlled for, point estimates and confidence intervals changed little with control for socioeconomic variables that represent mechanisms thought to be associated with healthy eating, such as

individuals' educational attainment[21–24] and the ability to afford healthy foods.[25–31]

In addition to socioeconomic factors, by design Black Americans were sampled primarily from North Carolina and Mississippi, whereas White Americans were sampled from Minnesota, Maryland, and North Carolina. Therefore, the associations observed between the local food environment and dietary intake may be specific to the geographic areas studied and results for Black and White Americans may not be comparable. However, when analyses were restricted to North Carolina, where both Black and White Americans were sampled, we still observed an increase in meeting recommendations for fruit and vegetable intake for Black Americans (RR=1.65; 95% CI=1.00, 2.71) but a decrease for White Americans (RR=0.89, 95% CI=0.70, 1.15). This interaction between race and the local food environment suggests there may be

other race-specific mechanisms involved in the relationship between the local food environment and dietary intake. For example, White Americans living in the areas under study had 3 times greater access to private transportation than Black Americans living in similar locations, so that White Americans had a larger geographic area in which to select places to patronize.[32] Therefore, White Americans may be less reliant than Black Americans on their immediate neighborhood for food.

This issue of transportation is one of many that make defining the local food environment for individuals difficult. Although research has shown that census tracts are good approximations for neighborhoods, without information on people's shopping habits there is no validation that people actually purchase food within their tract.[38] This may be more of an issue for individuals living on the boarder of 2 tracts, people who work

outside of their home, or people with access to transportation. In addition, although commercial geocoding is an efficient and cost-effective strategy for linking addresses to census tracts, addresses could have been misclassified with respect to neighborhood and residential characteristics, in which case our estimates may be biased. Using the number and type of stores as a proxy for the availability of healthy foods was also a limitation. We assumed that supermarkets offer the widest selection of foods at the lowest prices. However, these analyses may be improved with more specific information regarding the types and costs of foods sold at these establishments. Moreover, because the dietary data were collected before the local food environment data, we had to assume that the proportion of the various types of food stores and restaurants remained constant between 1993 and 1999. Finally, there are other factors that influence people's dietary choices that we were unable to control for; these may also be associated with the local food environment.

Although future studies may offer more information on pathways by which the local food environment is associated with dietary intake, these data show that the local food environment is associated with meeting dietary recommendations for some individuals. These findings are most pronounced for supermarkets, which generally offer a larger selection of foods at lower prices. Local food environments may become more equitable with changes in policy and resources that support a wider variety of healthy foods at lower prices in neighborhood grocery stores and encouragement of supermarkets to locate in low-income and Black neighborhoods. ∎

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