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# Neighborhood Racial Composition, Neighborhood Poverty, and the Spatial Accessibility of Supermarkets in Metropolitan Detroit

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Four of the 10 leading causes of death in the United States are chronic diseases for which diet is a major risk factor.<sup>1</sup> Racial disparities in the burden of these chronic, diet-related diseases are well documented, with African Americans often having the highest morbidity and mortality.<sup>2–5</sup> Because health risks and resources are spatially and socially structured and African Americans disproportionately live in economically disadvantaged neighborhoods, increased attention has been focused on how residential environments shape health and contribute to racial disparities in health.<sup>6–9</sup> An extensive body of literature now associates residence in economically disadvantaged neighborhoods, after control for individual socioeconomic status, with a variety of adverse diet-related health outcomes.<sup>10–12</sup>

Despite numerous research efforts that have examined neighborhood variations in health, relatively little is known about the mechanisms by which neighborhood environments affect health.<sup>13–15</sup> One hypothesis is that economically and socially disadvantaged neighborhoods have inadequate access to healthy foods, thus negatively affecting dietary quality and health. Although the presence of supermarkets may not always be beneficial for neighborhood residents (e.g., if supermarkets displace smaller stores with owners who had positively contributed to and invested in the neighborhood), such large stores can be neighborhood health resources providing generally better availability and selection, higher quality, and lower cost of foods compared with smaller food stores.<sup>16</sup> These food resource factors influence dietary patterns.<sup>17–24</sup> Previous studies have found that fewer supermarkets are located in African American neighborhoods compared with White neighborhoods<sup>25,26</sup> and are located in economically disadvantaged neighborhoods compared with affluent neighborhoods.<sup>16,26–29</sup>

**Objectives.** We evaluated the spatial accessibility of large “chain” supermarkets in relation to neighborhood racial composition and poverty.

**Methods.** We used a geographic information system to measure Manhattan block distance to the nearest supermarket for 869 neighborhoods (census tracts) in metropolitan Detroit. We constructed moving average spatial regression models to adjust for spatial autocorrelation and to test for the effect of modification of percentage African American and percentage poor on distance to the nearest supermarket.

**Results.** Distance to the nearest supermarket was similar among the least impoverished neighborhoods, regardless of racial composition. Among the most impoverished neighborhoods, however, neighborhoods in which African Americans resided were, on average, 1.1 miles further from the nearest supermarket than were White neighborhoods.

**Conclusions.** Racial residential segregation disproportionately places African Americans in more-impoverished neighborhoods in Detroit and consequently reduces access to supermarkets. However, supermarkets have opened or remained open close to middle-income neighborhoods that have transitioned from White to African American. Development of economically disadvantaged African American neighborhoods is critical to effectively prevent diet-related diseases among this population. (*Am J Public Health.* 2005;95:660–667. doi:10.2105/AJPH.2004.042150)

Other studies have found no differences in the accessibility of supermarkets according to racial or socioeconomic characteristics of neighborhoods.<sup>30–32</sup> This discrepancy could reflect either differences in the definition of supermarkets or true variability in results across time and place that may be caused by differences in the degree of racial or economic segregation. Lower purchasing power is an often-cited but disputed explanation for the relative scarcity of supermarkets in economically disadvantaged neighborhoods.<sup>33–35</sup>

Analysis of the role of race without regard to poverty and of poverty without regard to race offers an incomplete picture of the potential importance of these factors in shaping the spatial accessibility of supermarkets. Understanding these relationships is critical for informing intervention and policy efforts. Such an understanding is particularly important, given the roles of racial residential segregation and economic restructuring in

concentrating poverty in African American neighborhoods of older industrial cities of the Northeast and Upper Midwest.<sup>36–40</sup> Therefore, we sought to determine whether supermarkets are located at farther distances from the center of African American neighborhoods compared with White neighborhoods regardless of neighborhood economic conditions or if racial disparities in supermarket accessibility occur only in higher-poverty contexts.

## METHODS

### Setting and Sample

The setting for this study was the Detroit metropolitan area in Michigan. Metropolitan Detroit is characterized by extreme economic inequalities across neighborhoods.<sup>36</sup> Economic inequalities can be traced to the period just after World War II, when highway construction and cheap land outside the city led many industries to relocate to the suburbs.<sup>39,41–43</sup>

Between 1950 and 1990, the city of Detroit lost approximately 350 000 jobs,<sup>41,43,44</sup> largely owing to the relocation of industries to the suburbs, deindustrialization, and other facets of economic restructuring. At the same time, discriminatory federal housing policies and lending practices, racial steering (the act of real estate agents systematically showing African Americans to different neighborhoods than Whites), restrictive covenants, and violence created and reinforced racial residential segregation in metropolitan Detroit. In effect, African Americans were confined to the least desirable, older residential neighborhoods of the city, whereas Whites were able to move to more desirable, newer suburban locations.<sup>35,37,41,44–47</sup> The city of Detroit shifted from 16.2% African American in 1950 to 81.2% African American in 2000,<sup>43,48</sup> a sharp contrast with the 84.8% of metropolitan Detroit residents outside the city limits who identified as non-Hispanic White in 2000.<sup>48</sup> Metropolitan Detroit remains one of the most racially segregated areas in the United States—ranked second overall in residential segregation of African Americans in 2000.<sup>49</sup> The sample for this study was 869 neighborhoods (we used census tracts as proxies) in the tri-county Detroit metropolitan area. These neighborhoods are located in the city of Detroit and in the tricounty Detroit metropolitan area (Wayne, Oakland, Macomb counties) within a 10-mile buffer of Detroit.

**Measures**

We used 2000 decennial census data to characterize the neighborhoods. Population density was computed as the total population per square mile (median = 5367.44). Racial composition was defined as the percentage of non-Hispanic African American residents (median = 6.06%). Neighborhood poverty was defined as the percentage of residents below the poverty line (median = 8.21%). Tertiles for percentage of African American residents (0%–1.98%, 1.99%–62.63%, and 63.11%–98.43%) and percentage of residents in poverty (0%–5.03%, 5.10%–17.20%, and 17.23%–81.96%) were used in statistical analyses. Given that 92% of residents in tri-county metropolitan Detroit were either non-Hispanic White (67.3%) or non-Hispanic African American (24.9%), neighborhoods with

**TABLE 1—No. of Chain Supermarkets, by Type, in Detroit and Within 15 Miles: Tricounty Detroit Metropolitan Area, 2002**

	No. of Chain Supermarkets
City of Detroit	
Total supermarkets	9
Full-line grocery stores	7
Supercenters	2
Tricounty Detroit metropolitan area (excluding city of Detroit)	
Total supermarkets	151
Full-line grocery stores	123
Supercenters	28
Total supermarkets	160

*Note.* We did not include wholesale clubs (e.g., Sam’s Club) or limited-assortments stores (e.g., Save-A-Lot), which are generally smaller and offer a more limited variety of foods, in the sample.<sup>50</sup>

low proportions of African Americans generally correspond with predominately White neighborhoods.

Supermarkets were defined as supercenters (e.g., Meijer, Super Kmart) and full-line grocery stores (e.g., Farmer Jack, Kroger) associated with a national or regional grocery chain, i.e., a chain with 11 or more retail stores.<sup>50</sup> To identify supermarkets, we obtained a 2001 list of grocery stores from the Michigan Department of Agriculture. We used 2001–2002 paper telephone directories, as well as online telephone directories and company Web sites, in the fall of 2002 to verify the addresses of these supermarkets and to identify additional supermarkets. We confirmed the address of any supermarket not on the Michigan Department of Agriculture list by telephoning the store. One hundred and sixty supermarkets were identified in Detroit and in the metropolitan area within a 15-mile buffer of Detroit (Table 1). The additional 5-mile buffer of supermarkets around the sampled neighborhoods helped to ensure that we could calculate supermarket accessibility for neighborhoods at the periphery. We used geographic information system software (ArcView 3.3, Environmental Systems Research Institute, Redlands, Calif) to geocode 97% of the supermarkets (n = 155) to the

2000 US Census TIGER street file on the basis of the street address; the remaining 3% (n = 5) were geocoded on the basis of the closest street intersection.

The spatial accessibility of supermarkets was measured as the Manhattan block distance to the nearest supermarket. Manhattan block distance is defined as follows:

$$(1) \quad d_{ij} = |x_i - x_j| + |y_i - y_j|$$

where  $d_{ij}$  is the distance between origin  $i$  and destination  $j$  and  $x$  and  $y$  are the latitude and longitude coordinates of origin  $i$  and destination  $j$ . This distance measure is useful when it is reasonable to assume that residents travel to the supermarket on an angular route rather than in a straight line (a Euclidean distance measure).<sup>51</sup> We used geographic information system software (ArcView 3.3) and SpaceStat 1.93 (TerraSeer, Ann Arbor, Mich) to calculate Manhattan block distance on the basis of the geographic coordinates of neighborhood centroids and supermarkets. The centroids (geometric centers) served as proxies of the locations of these neighborhoods. Thus, supermarket accessibility represents the distance to the nearest supermarket for a resident positioned in the middle of the neighborhood.<sup>51</sup> The median Manhattan block distance to the nearest supermarket was 1.43 miles (range: 0.05 to 5.05 miles).

**Data Analysis**

Spatial data are frequently characterized by positive spatial autocorrelation, or the tendency for neighborhoods that are near each other in space to share similar attributes.<sup>52</sup> This tendency may result in biased and inefficient parameter estimates when ordinary least squares (OLS) regression is applied.<sup>53</sup> We used Moran’s I statistic to test for evidence of spatial autocorrelation in residuals from OLS regression models (Table 2). We found such evidence. Therefore, we used moving average spatial regression<sup>57,58</sup> to adjust for spatial autocorrelation and to estimate the relationships between tertiles of percentage African American, tertiles of percentage poor, and distance to the nearest supermarket (S+ ArcView and S+ SpatialStats).<sup>57</sup> Moran’s I statistic also was used to test residuals from spatial regression models. Although not the standard test for spatial autocorrelation in regression model

**TABLE 2—Manhattan Block Distance (in Miles) to the Nearest Supermarket Regressed on Neighborhood Characteristics<sup>a</sup> With Ordinary Least Squares Regression and Moving Average Spatial Regression<sup>b</sup>**

	Model 1		Model 2	
	OLS Coefficient (SE)	Spatial Coefficient (SE)	OLS b Coefficient (SE)	Spatial Coefficient (SE)
African American, %				
1.98–62.63 (Medium)	0.086 (0.068)	0.092 (0.067)	-0.042 (0.096)	-0.028 (0.097)
63.11–98.43 (High)	0.273 (0.087)**	0.295 (0.088)***	-0.004 (0.316)	-0.002 (0.314)
Poor, %				
5.03–17.20 (Medium)	0.010 (0.068)	-0.021 (0.068)	-0.048 (0.098)	-0.052 (0.097)
17.23–81.96 (High)	0.777 (0.092)***	0.703 (0.092)***	0.050 (0.238)	-0.190 (0.239)
Medium African American × medium poverty			0.115 (0.140)	0.078 (0.140)
Medium African American × high poverty			0.999 (0.268)***	1.125 (0.266)***
High African American × medium poverty			0.365 (0.340)	0.319 (0.337)
High African American × high poverty			0.956 (0.418)*	1.153 (0.391)**
P		<.001		.002
Adjusted R <sup>2</sup>	0.21		0.22	
Log likelihood		-2699		-2691
Likelihood ratio test				15.83 <sup>c</sup> ***
Moran's I statistic on residuals	0.008	<0.001	0.018	0.004
Normal statistic	2.14*	0.37	4.31***	1.08

Note. OLS = ordinary least squares.

<sup>a</sup>Adjusted for population density.

<sup>b</sup>A binary 5-mile spatial weights matrix was used. This decision was based on exploratory analysis with an empirical semivariogram,<sup>54,55</sup> which showed a 5-mile range for spatial autocorrelation for distance to the nearest supermarket. This distance conformed to available data on average travel distance to the supermarket.<sup>56</sup> We also compared results with 2 other specifications. Results were similar based on a binary 3-mile spatial weights matrix. The interaction coefficients with a rook (neighborhoods sharing a common border) spatial weights matrix were in the correct direction but were not statistically significant. Neither alternative spatial model corrected for spatial autocorrelation. The moving average spatial regression technique is described elsewhere.<sup>57,58</sup>

<sup>c</sup>Spatial regression model 1 compared with spatial regression model 2. Critical value for  $\chi^2=0.01, 4 df=13.28$ .

\* $P < .05$ ; \*\* $P < .01$ ; \*\*\* $P < .001$ .

residuals, Moran's I statistic can be useful for comparative purposes.<sup>57,59</sup>

Preliminary analyses also revealed evidence of a linear spatial trend<sup>59,60</sup>; the longitude coordinate for neighborhood centroids was a statistically significant negative predictor of distance to the nearest supermarket. This negative predictor suggested better accessibility to the north, possibly because of greater commercial development in the northern part of the metropolitan area. Therefore, we removed the spatial linear trend in distance to the nearest supermarket for the spatial regression analyses by subtracting the product of the longitude coordinate (in miles) and the OLS parameter estimate for the longitude coordinate from the dependent variable.

## RESULTS

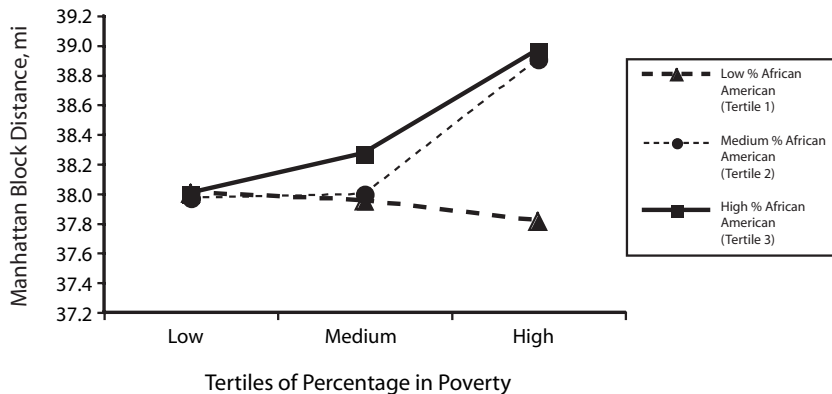
Table 2 presents results for Manhattan block distance to the nearest supermarket—regressed

on percentage African American, percentage poor, and their interaction—adjusted for population density. In model 1, Manhattan block distance to the nearest supermarket was regressed on tertiles of percentage African American and percentage poor. In model 2, we added terms to capture the effects of interaction between tertiles of percentage African American and percentage poor. The nonsignificant Moran's I statistics suggest that the spatial models successfully adjusted for spatial autocorrelation. Thus, we focused on the interpretation of the spatial regression results.

As shown in model 1, the nearest supermarket was significantly further away in neighborhoods with a high proportion of African Americans (tertile 3) and in the most impoverished (tertile 3) neighborhoods compared with neighborhoods with a low proportion of African Americans (tertile 1) and the least impoverished (tertile 1) neighborhoods, respectively. (These results were adjusted for population density.) In model 2, 2 of the 4

terms to capture the effects of interaction between percentage African American and percentage poor were statistically significant. Moreover, the addition of interaction terms significantly improved the fit of the spatial model, as shown by results of the likelihood ratio test ( $\chi^2=15.83, P<.01$ ).

To examine the interaction between tertiles of percentage African American and percentage poor, we calculated and plotted predicted values for distance to the nearest supermarket by tertiles of percentage African American and percentage poor (Figure 1). Mean distance to the nearest supermarket was similar in the least impoverished (tertile 1) neighborhoods across all tertiles of percentage African American residents (Figure 1). Mean distance to the nearest supermarket increased with each successive tertile of percentage poor for neighborhoods with a high proportion of African Americans but remained approximately the same across all tertiles of percentage poor for neighborhoods with a low



Note. Because the spatial linear trend was removed from distance to the nearest supermarket, the absolute values of the predicted values along the y-axis are not meaningful. The relative differences among groups are meaningful.

**FIGURE 1—Predicted values for Manhattan block distance (in miles) to the nearest supermarket, by tertiles of percentage African American and percentage poor.**

proportion of African Americans (predominately White). Among the most impoverished neighborhoods, distance to the nearest supermarket varied considerably by percentage African American, with the nearest supermarket averaging 1.10 to 1.15 miles farther in neighborhoods with medium (tertile 2) and high (tertile 3) proportions of African Americans, respectively, than in neighborhoods with low proportions of African Americans (tertile 1).

## DISCUSSION

### Disparities in Supermarket Accessibility

The relationship between neighborhood racial composition and supermarket accessibility varied according to neighborhood poverty level in metropolitan Detroit. The distance to the nearest supermarket was similar among the least impoverished neighborhoods across the 3 tertiles of percentage African American. However, disparities in supermarket accessibility on the basis of race were evident among the most impoverished neighborhoods: the most impoverished neighborhoods in which African Americans resided, on average, were 1.1 miles farther from the nearest supermarket than were the most impoverished White neighborhoods. Most African Americans in tricounty metropolitan Detroit reside in neighborhoods that are in the upper tertile for percentage poor and that have either a high proportion of African Americans

(60%) or a medium proportion of African Americans (20%), as defined in this study.

Inadequate accessibility to supermarkets may contribute to less-nutritious diets and hence to greater risk for chronic, diet-related diseases. In a recent qualitative study, Detroit residents reported that lack of access to supermarkets was a barrier to healthy eating.<sup>61</sup> At least 3 previous quantitative studies, all of which examined chain supermarkets, have suggested that closer proximity to supermarkets is associated with better-quality diets.<sup>62–64</sup> The observation that the nearest supermarket averaged 1.1 miles further in the most impoverished neighborhoods in which African Americans resided (tertile 3 poverty, tertiles 2 and 3 African American) compared with the most impoverished White neighborhoods (tertile 3 poverty, tertile 1 African American) is particularly salient, given that 23% and 28% (tertiles 2 and 3 African American) of households in the most impoverished neighborhoods in which African Americans resided did not own a car in 2000.

We began the study with 3 measures of supermarket accessibility: distance to the nearest supermarket, number of supermarkets within a 3-mile radius (considered reachable by car), and potential supermarket accessibility (sum of the inverse Euclidean distances between the neighborhood and all supermarkets).<sup>65</sup> Because the patterns of these relationships were similar, we present only distance to the

nearest supermarket. For all 3 measures, supermarket accessibility was comparable among the least impoverished neighborhoods regardless of neighborhood racial composition, whereas disparities were evident among the most impoverished neighborhoods. The most impoverished neighborhoods in which African Americans resided (tertiles 2 and 3 African American) averaged 2.3 and 2.7 (respectively) fewer supermarkets within a 3-mile radius and had lower potential supermarket accessibility relative to the most impoverished White neighborhoods (analyses not shown).

Race appears to be an important factor with respect to supermarket accessibility in the context of more impoverished neighborhoods; 76% of neighborhoods with a high proportion of African Americans were among the most impoverished. The disproportionate representation of African Americans in more impoverished neighborhoods in Detroit can be traced historically. Until the 1940s—a decade in which Detroit's African American population doubled from 149 119 to 300 506 because of the influx of African Americans from the South for manufacturing jobs—African Americans generally resided in central Detroit and east central Detroit.<sup>66,67</sup> Facing overcrowded and substandard housing, African Americans began moving to other parts of the city.<sup>39,66,68</sup> Nevertheless, institutional racism—specifically racial residential segregation—confined African Americans to Detroit neighborhoods that began losing employment opportunities, particularly in the manufacturing industry, in the 1950s.<sup>39,41,44</sup> Between 1948 and 1967, Detroit lost nearly 130 000 manufacturing jobs.<sup>39</sup>

Often confronting strong resistance from Whites, African Americans first moved to nearby neighborhoods in central Detroit.<sup>46,69</sup> Hence, many neighborhoods located in central Detroit<sup>68</sup> transitioned from White to African American in the 1950s and 1960s when African Americans moved in and Whites moved out to newly constructed housing in northeast and northwest Detroit and the suburbs. Businesses closed soon thereafter, particularly after the 1967 racial discord, further compounding the adverse economic impact of the loss of manufacturing jobs.<sup>39,44,70</sup> Hence, the number of abandoned homes and businesses, including grocery stores, grew, and poverty increased substantially.



This pattern of White flight and economic divestment was repeated during several decades across Detroit neighborhoods. Residential patterns of African Americans generally expanded outward in a stepwise progression from central and east central Detroit toward the northern city boundaries and eventually to Southfield, a suburb adjacent to northwest Detroit.<sup>39,44,69</sup> Neighborhoods located in the northernmost portion of Detroit near Eight Mile Road, the infamous African American–White racial dividing line of metropolitan Detroit, and particularly in northwest and northeast Detroit were among the most recent neighborhoods to transition from White to African American. Some neighborhoods, such as those in the far northwest Detroit community of Redford, shifted to African American as late as the 1990s.<sup>44,69,71,72</sup> Similarly, in the suburb of Southfield, the African American population has grown tremendously, from 102 people (0.1% of the population) in 1970 to 42 259 people (54%) in 2000.<sup>69</sup> The number of African Americans in Southfield increased by 48% between 1990 and 2000 alone, despite an increase of only 3% in the city's total population.

This social history of metropolitan Detroit neighborhoods is relevant to our study because, among the least impoverished neighborhoods, all but 1 of the predominately African American neighborhoods with supermarket accessibility equivalent to that of their predominately White counterparts were located in northwest and north central Detroit and in Southfield. An optimistic interpretation of our findings is that supermarkets have newly opened or have remained open in or nearby these middle-income, yet racially transitioning, neighborhoods. This interpretation provides hope that supermarkets will invest or stay invested in African American neighborhoods as long as the residents have sufficient purchasing power to make these outlets profitable. An alternative interpretation of the findings is that among the least impoverished neighborhoods, African American neighborhoods have supermarket accessibility equivalent to that of predominantly White neighborhoods only because the supermarkets located in and nearby are remnants of historically White neighborhoods. Longitudinal data are needed to empirically test these different the-

ories. If these areas remain African American, if they maintain a middle-income population, and if supermarkets remain open in or near these neighborhoods, then economic development may be a key intervention strategy to improve supermarket accessibility in African American neighborhoods. If, conversely, supermarkets close or do not open new sites in these economically stable African American neighborhoods, then factors associated with race are a more likely cause of disparities in supermarket accessibility. Indeed, our finding of disparate supermarket accessibility among the most impoverished neighborhoods by neighborhood racial composition warrants further investigation to identify contributing factors.

### Limitations

Our study has several limitations. First, chain supermarket accessibility was used as a proxy for better access to a good selection of high-quality, lower-cost healthy foods. This decision was based in part on evidence that selection, quality, and prices of foods are generally better at larger stores<sup>16</sup> and that chain grocers are usually larger than independent grocers.<sup>65</sup> In addition, chain supermarkets account for 84% of total sales among grocery stores with at least \$2.0 million in annual sales,<sup>73</sup> and some research suggests that African Americans prefer to shop at full-service, chain supermarkets.<sup>56</sup> Direct measurement and comparison of the availability, selection, quality, and cost of healthy foods at retail outlets by neighborhood racial and economic characteristics is an important objective for future research.

Second, travel time may be a more informative indicator of accessibility than physical distance, although some studies suggest that Euclidean or straight-line distance (strongly related to Manhattan block distance) approximates travel time.<sup>74,75</sup> Given that the most impoverished and African American neighborhoods are concentrated in the more densely populated central city of Detroit, where travel times to supermarkets are likely longer, the implication of our approach is that findings of differences in accessibility by race and poverty are likely conservative. Moreover, we did not consider social barriers (e.g., crime) or other nonspa-

tial factors (e.g., store operating hours) that affect accessibility, nor did we consider individual access to supermarkets, which will vary by residents' locations within neighborhoods and by individual mobility resources such as time, access to a car, income, and physical functioning.<sup>76</sup> Where possible, future studies should use travel times to measure supermarket accessibility.

Third, the strong correlation between race and poverty in the sample ( $r=0.70$ ) necessitated the use of rather gross categories (tertiles) to estimate interactions between race and poverty. Nevertheless, a statistically significant effect of race, even in moderately adverse economic circumstances (the lower bound for the most impoverished neighborhoods was 17.23%), was observed. If it had been possible to use a higher threshold to define "high-poverty" neighborhoods, stronger interaction effects may have been observed. Furthermore, when the 869 neighborhoods were cross-classified by race and poverty tertiles, only 11 were White (tertile 1 African American) and in the highest tertile for percentage poor and only 6 were African American (tertile 3) and in the lowest tertile for percentage poor. Despite these small sample sizes, we observed statistically significant interactions. Future research in other urban settings with greater economic diversity among White and African American neighborhoods (e.g., greater representation of higher-poverty, White neighborhoods) is warranted to test for effect modification of race and poverty on supermarket accessibility.

Fourth, the cross-sectional nature of the study precludes definitive establishment of causal ordering among neighborhood racial composition, neighborhood poverty, and supermarket accessibility. Some of the supermarkets were built in the past 10 years, but many were built much longer ago. The characteristics of neighborhoods today and especially historically (e.g., the past 3 or 4 decades) have shaped the spatial landscape of supermarkets across metropolitan Detroit. Longitudinal analyses would help to elucidate the dynamic relationships between neighborhood racial and economic transitioning and supermarket accessibility. Indeed, a year after data collection for this study was completed, 6 of the 9 chain supermarkets in

the city of Detroit had closed or were scheduled to close, and only 1 new chain supermarket had opened,<sup>77–80</sup> despite Detroit's having a population of approximately 950 000 residents.

### Practice and Policy Implications

The results of this study have several practice and policy implications. Pursuit of these strategies would benefit from a partnership approach between public health professionals and community members to ensure the local relevance of intervention strategies and to enhance community capacity for future intervention efforts.<sup>81</sup> In the first of these implications, the results suggest the critical importance of working to redress fundamental inequalities between African Americans and Whites in order to reduce chronic, diet-related diseases among African Americans.<sup>82</sup> For example, the economic development of African American neighborhoods could be enhanced by policies of creating jobs that pay a fair wage, to improve educational quality and opportunities for adults to increase job skills, to subsidize child care, and to attract new businesses. Second, working to attract supermarkets to economically disadvantaged African American neighborhoods in Detroit is a specific economic development strategy that may directly improve food access. Supermarket development can enhance local economic vitality by (1) providing jobs for residents, (2) increasing the local tax base, (3) making foods available at lower prices, thereby increasing the spending power of residents, and (4) attracting other forms of retail.<sup>34,35,83</sup> Supporting African American ownership of and employment at these supermarkets may be critical to their acceptance and success.<sup>56</sup>

Third, a metropolitanwide planning approach to the food system needs to be pursued.<sup>84</sup> Ideally, the food system would be evaluated holistically to ensure that all communities are served equitably. Fourth, in the short term, inadequate transportation is a significant barrier for residents of economically disadvantaged African American neighborhoods' gaining access to supermarkets.<sup>61</sup> Affordable public transportation needs to be improved by integrating transportation routes with supermarket locations.<sup>85,86</sup>

Fifth, on the basis of our findings of disparate access to supermarkets among the most impoverished neighborhoods by percentage African American residents, efforts to expand the Community Reinvestment Act, a law designed to combat discrimination in commercial real estate lending, may be warranted. Finally, given that racial ideologies are likely to shape the political will to pursue these intervention strategies, public health researchers and practitioners need to work to challenge racial stereotypes in public discourse.<sup>42,43,87</sup>

Helping to contextualize the plight of African Americans historically and spatially and to identify its ramifications for health were the primary intents of this study. We found that the historically influenced concentration of African Americans in higher-poverty neighborhoods in Detroit adversely affects spatial access to supermarkets, a resource of potential great importance in promoting the health of African Americans. ■

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### Contributors

S.N. Zenk developed the study, collected the data, and led the data analysis and writing. A.J. Schulz, B.A. Israel, S.A. James, and M.L. Wilson contributed to the conceptualization of the study and interpretation of the results. S. Bao participated in the data analysis and interpretation of results. All authors reviewed and helped to revise drafts of the article.

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### Human Participant Protection

No human participant protocol approval was needed for this study.

### References

1. National Center for Health Statistics, Centers for Disease Control and Prevention. Deaths—leading causes. Available at: <http://www.cdc.gov/nchs/fastats/lcod.htm>. Accessed February 13, 2004.
2. Fried VM, Prager K, MacKay AP, Xia H. Chartbook on trends in the health of Americans. In: *Health, United States, 2003*. Hyattsville, Md: National Center for Health Statistics; 2003.
3. Jemal A, Thomas A, Murray T, Thun M. Cancer statistics, 2002. *CA Cancer J Clin*. 2002;52:23–47.
4. Ries LAG, Eisner MP, Kosary CL, et al, eds. SEER cancer statistics review, 1973–1999. Bethesda, Md: National Cancer Institute; 2002. Available at: [http://seer.cancer.gov/csr/1973\\_1999](http://seer.cancer.gov/csr/1973_1999). Accessed February 13, 2004.
5. *Healthy People 2010: Understanding and Improving Health*. Washington, DC: US Dept of Health and Human Services; 2001. Also available at: <http://web.health.gov/healthypeople/document>. Accessed January 1, 2005.
6. Fitzpatrick K, LaGory M. *Unhealthy Places: The Ecology of Risk in the Urban Landscape*. New York, NY: Routledge; 2000.
7. Lillie-Blanton M, LaVeist T. Race/ethnicity, the social environment, and health. *Soc Sci Med*. 1996;43:83–91.
8. Macintyre S, Maciver S, Sooman A. Area, class, and health: should we be focusing on places or people? *J Soc Policy*. 1993;22:213–234.
9. Yen I, Syme SL. The social environment and health: a discussion of the epidemiologic literature. *Annu Rev Public Health*. 1999;20:287–308.
10. Ellen I, Mijanovich GT, Dillman K. Neighborhood effects on health: exploring the links and assessing the evidence. *J Urban Aff*. 2001;23:391–408.
11. Pickett KE, Pearl M. Multilevel analyses of neighborhood socioeconomic context and health outcomes: a critical review. *J Epidemiol Community Health*. 2000;55:111–122.
12. Robert SA. Socioeconomic position and health: the independent contribution of community socioeconomic context. *Annu Rev Sociol*. 1999;25:489–516.
13. Diez Roux AV. Investigating neighborhood and area effects on health. *Am J Public Health*. 2001;91:1783–1789.
14. Hillemeier MM, Lynch J, Harper S, Casper M. Measuring contextual characteristics for community health. *Health Serv Res*. 2004;38:1645–1717.
15. Macintyre S, Ellaway A, Cummins S. Place effects on health: how can we conceptualize, operationalize, and measure them? *Soc Sci Med*. 2002;55:125–139.
16. Mantovani RE, Daft L, Macaluso TF, Welsh J, Hoffman K. *Authorized Food Retailers' Characteristics and Access Study*. Alexandria, Va: US Dept of Agriculture; 1997.
17. Cheadle A, Psaty BM, Curry S, et al. Community-level comparisons between the grocery store environment and individual dietary practices. *Prev Med*. 1991;20:250–261.

18. Cohen NL, Stoddard AM, Sarouhkhanians S, Sorensen G. Barriers toward fruit and vegetable consumption in a multiethnic worksite population. *J Nutr Educ*. 1998;30:381–386.
19. Drewnowski A, Specter SE. Poverty and obesity: the role of energy density and energy costs. *Am J Clin Nutr*. 2004;79:6–16.
20. French SA, Story M, Jeffery RW. Environmental influences on eating and physical activity. *Annu Rev Public Health*. 2001;22:309–335.
21. Furst T, Connors M, Bisogni CA, Sobal J, Falk LW. Food choice: a conceptual model of the process. *Appetite*. 1996;26:247–266.
22. Glanz K, Basil M, Mailbach E, Goldberg J, Snyder D. Why Americans eat what they do: taste, nutrition, cost, convenience, and weight control concerns as influences on food consumption. *J Am Diet Assoc*. 1998;98:1118–1126.
23. Huang K. Role of national income and prices. In: Frazao E, ed. *America's Eating Habits: Changes and Consequences*. US Dept of Agriculture; 1999:161–171. Agriculture Information Bulletin No. 750.
24. Reicks M, Randall J, Haynes B. Factors affecting vegetable consumption in low-income households. *J Am Diet Assoc*. 1994;94:1309–1311.
25. Race and place matter for major Chicago area grocers. Chicago, Ill: Metro Chicago Information Center. Available at: <http://www.mciic.org>. Accessed January 3, 2005.
26. Morland K, Wing S, Diez Roux A, Poole C. Neighborhood characteristics associated with the location of food stores and food service places. *Am J Prev Med*. 2002;22:23–29.
27. Alwitt LF, Donley TD. Retail stores in poor urban neighborhoods. *J Consum Aff*. 1997;31:139–164.
28. Chung C, Myers SL. Do the poor pay more for food? An analysis of grocery store availability and food price disparities. *J Consum Aff*. 1999;33:276–296.
29. Cotterill RW, Franklin AW. *The Urban Grocery Store Gap*. Storrs, Conn: Food Marketing Policy Center, University of Connecticut; 1995.
30. Cummins S, Macintyre S. A systematic study of an urban foodscape: the price and availability of food in Greater Glasgow. *Urban Stud*. 2002;39:2115–2130.
31. Cummins S, Macintyre S. “Food deserts”—Evidence and assumption in health policy making. *BMJ*. 2002;325:436–438.
32. Jones SJ. *The Measurement of Food Security at the Community Level: Geographic Information Systems and Participatory Ethnographic Methods* [dissertation]. Chapel Hill, NC: University of North Carolina at Chapel Hill; 2002.
33. Donohue RM. *Abandonment and Revitalization of Central City Retailing: The Case of Grocery Stores* [dissertation]. Ann Arbor, Mich: University of Michigan; 1997.
34. The business case for pursuing retail opportunities in the inner city. Boston, Mass: The Boston Consulting Group and The Initiative for a Competitive Inner City; 1998. Available at: <http://www.icic.org>. Accessed January 3, 2005.
35. The changing models of inner city grocery retailing. Boston, Mass: The Initiative for a Competitive Inner City; 2002. Available at: <http://www.icic.org>. Accessed January 3, 2005.
36. Jargowsky PA. *Poverty and Place: Ghettos, Barrios, and the American City*. New York, NY: Russell Sage Foundation; 1997.
37. Massey DS, Denton NA. *American Apartheid: Segregation and the Making of the Underclass*. Cambridge, Mass: Harvard University Press; 1993.
38. Massey DS, Fischer MJ. How segregation concentrates poverty. *Ethn Racial Stud*. 2000;23:670–691.
39. Sugrue TJ. *The Origins of the Urban Crisis: Race and Inequality in Postwar Detroit*. Princeton, NJ: Princeton University Press; 1996.
40. Wilson WJ. *The Truly Disadvantaged: The Inner City, the Underclass, and Public Policy*. Chicago, Ill: University of Chicago Press; 1987.
41. Farley R, Danziger S, Holzer HJ. *Detroit Divided*. New York, NY: Russell Sage Foundation; 2000.
42. Geronimus AT. To mitigate, resist, or undo: addressing structural influences on the health of urban populations. *Am J Public Health*. 2000;90:867–872.
43. Schulz A, Williams DR, Israel B, Lempert LB. Racial and spatial relations as fundamental determinants of health in Detroit. *Milbank Q*. 2002;80:677–707.
44. Darden JT, Hill RC, Thomas J, Thomas R. *Detroit: Race and Uneven Development*. Philadelphia, Pa: Temple University Press; 1987.
45. Collins CA, Williams DR. Segregation and mortality: the deadly effects of racism. *Social Forum*. 1999;14:495–523.
46. Thomas JM. *Redevelopment and Race: Planning a Finer City in Postwar Detroit*. Baltimore, Md: The Johns Hopkins University Press; 1997.
47. Williams DR, Collins CA. Racial residential segregation: a fundamental cause of racial disparities in health. *Public Health Rep*. 2001;116:404–416.
48. *Michigan Metropolitan Information Center 2000 Census Demographic Characteristics*. Detroit, Mich: The Center for Urban Studies, Wayne State University. Available at: <http://www.cus.wayne.edu/census/censuspubs.aspx>. Accessed January 3, 2005.
49. Iceland J, Weinberg DH, Steinmetz E. *Racial and Ethnic Residential Segregation in the United States: 1980–2000*. Washington, DC: US Government Printing Office; 2002. US Census Bureau. Series CENSR-3.
50. *Supermarket Facts Industry Overview 2002*. Washington, DC: Food Marketing Institute; 2002. Available at: [http://www.fmi.org/facts\\_figs/superfact.htm](http://www.fmi.org/facts_figs/superfact.htm). Accessed April 21, 2004.
51. Gimpel JG, Schuknecht JE. Political participation and the accessibility of the ballot box. *Polit Geogr*. 2003;22:471–488.
52. Anselin L. Interactive techniques and exploratory spatial data analysis. In: Longley PA, Goodchild MF, Maguire DJ, Rhind DW, eds. *Geographic Information Systems: Principles, Techniques, Management, and Applications*. New York, NY: John Wiley & Sons; 1999: 253–266.
53. Anselin L. *Spatial Econometrics: Methods and Models*. Boston, Mass: Kluwer Academic; 1988.
54. Legendre P, Fortin MJ. Spatial pattern and ecological analysis. *Vegetatio*. 1989;80:107–138.
55. Stralberg D, Bao S. Identifying the spatial structure in error terms with spatial covariance models: a case study on urbanization influence in chaparral bird species. *Geographic Information Sciences*. 1999;5: 106–20.
56. *The African American Grocery Shopper 2000*. Washington DC: Food Marketing Institute; 2000.
57. Kaluzny SP, Vega SC, Cardoso TP, Shelly AA. *S+ SpatialStats User's Manual for Windows and UNIX*. New York, NY: Springer; 1998.
58. Cressie NAC. *Statistics for Spatial Data*. New York, NY: John Wiley & Sons; 1993.
59. Bailey TC, Gatrell AC. *Interactive Spatial Data Analysis*. Essex, UK: Addison Wesley Longman; 1995.
60. Haining R. *Spatial Data Analysis: Theory and Practice*. Cambridge, Mass: Cambridge University Press; 2003.
61. Kieffer E, Willis S, Odoms-Young A, et al. Reducing disparities in diabetes among African American and Latino residents of Detroit: the essential role of community planning focus groups. *Ethn Dis*. 2004;14:S1-27–S1-37.
62. Laraia BA, Siega-Riz AM, Kaufman JS, Jones SJ. Proximity to supermarkets is positively associated with diet quality index for pregnancy. *Prev Med*. 2004;39: 869–875.
63. Morland K, Wing S, Diez Roux A. The contextual effect of the local food environment on residents' diets: the atherosclerosis risk in communities study. *Am J Public Health*. 2002;92:1761–1767.
64. Wrigley N, Warm D, Margetts B, Whelan A. Assessing the impact of improved retail access on diet in a “food desert”: a preliminary report. *Urban Stud*. 2002;39:2061–2082.
65. Zenk SN. *Neighborhood Racial Composition, Neighborhood Poverty, and Food Access in Metropolitan Detroit: Geographic Information Systems and Spatial Analysis* [dissertation]. Ann Arbor, Mich: University of Michigan; 2004.
66. Hartigan J. *Racial Situations: Class Predicaments of Whiteness in Detroit*. Princeton, NJ: Princeton University Press; 1999.
67. Zunz O. *The Changing Face of Inequality: Urbanization, Industrial Development, and Immigrants in Detroit, 1880–1920*. Chicago, Ill: University of Chicago Press; 1982.
68. McWhirter C. Life of one street mirrors city's fall: racial fears trigger white flight in '50s. *The Detroit News*. June 17, 2001. Available at: <http://www.detroitnews.com/specialreports/2001/elmhurst>. Accessed January 5, 2005.
69. Metzger K, Booza J. *African Americans in the United States, Michigan, and Metropolitan Detroit*. Detroit, Mich: Center for Urban Studies, Wayne State University; 2002. Center for Urban Studies Working Paper Series, No. 8.
70. McWhirter C. 1967 riot sent street into wrenching spiral: once stable block withers as property owners desert. *The Detroit News*. June 18, 2001. Available at: <http://www.detroitnews.com/specialreports/2001/elmhurst>. Accessed January 5, 2005.
71. *1990 Census Subcommunity Profiles for the City of Detroit*. Detroit, Mich: Southeast Michigan Census Council; 1993.
72. *2000 Census Subcommunity Profiles for the City of*



Detroit. Detroit, Mich: United Way Community Services; 2001.

73. [Key Facts: Supermarket Sales](#). Washington, DC: Food Marketing Institute; 2004. Available at: [http://www.fmi.org/facts\\_figs/keyfacts/grocery.htm](http://www.fmi.org/facts_figs/keyfacts/grocery.htm). Accessed June 9, 2004.

74. Fortney J, Rost K, Warren J. Comparing alternative methods of measuring geographic access to health services. *Health Services and Outcomes Research Methodology*. 2000;1:173–184.

75. Martin D, Wrigley H, Barnett S, Roderick P. Increasing the sophistication of access measurement in a rural healthcare study. *Health Place*. 2002;8:3–13.

76. Kwan M. Gender and individual access to urban opportunities: a study using space-time measures. *Prof Geogr*. 1999;51:210–227.

77. Bott J. Reaction in Detroit: residents feel angry, betrayed by decision. *The Detroit Free Press*. January 15, 2003. Available at: [http://www.freep.com/money/business/kdet15\\_20030115.htm](http://www.freep.com/money/business/kdet15_20030115.htm). Accessed January 3, 2005.

78. Dixon J. Farmer Jack drops 4 stores. *The Detroit Free Press*. March 28, 2003. Available at: [http://www.freep.com/money/business/fj28\\_20030328.htm](http://www.freep.com/money/business/fj28_20030328.htm). Accessed January 3, 2005.

79. Guest G. Farmer Jack will close 13 metro stores. *The Detroit Free Press*. January 7, 2004. Available at: [http://www.freep.com/money/business/fjack7\\_20040107.htm](http://www.freep.com/money/business/fjack7_20040107.htm). Accessed January 3, 2005.

80. Haber G. A nearby convenience: new Farmer Jack store gives city residents a grocery shopping option closer to home. *The Detroit Free Press*. June 26, 2003. Available at: [http://www.freep.com/money/business/farmer26\\_20030626.htm](http://www.freep.com/money/business/farmer26_20030626.htm). Accessed January 3, 2005.

81. Israel BA, Schulz AJ, Parker EA, Becker AB. Review of community-based research: assessing partnership approaches to improve public health. *Annu Rev Public Health*. 1998;19:173–201.

82. James SA. Primordial prevention of cardiovascular disease among African Americans: a social epidemiological perspective. *Prev Med*. 1999;29:S84–S89.

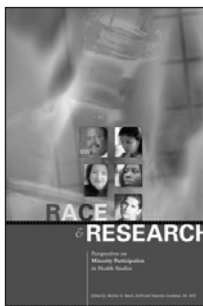
83. Pothukuchi K. Attracting supermarkets to inner city neighborhoods: economic development out of the box. *Econ Dev Q*. In press.

84. Pothukuchi K, Kaufman JL. Placing the food system on the urban agenda: the role of municipal institutions in food systems planning. *Agric Human Values*. 1999;16:213–224.

85. Ashman L, Vega J, Dohan M, Fisher A, Hippler R, Romain B. *Seeds of Change: Strategies for Food Security for the Inner City*. Los Angeles, Calif: University of California Los Angeles; 1993.

86. Gottlieb R, Fisher A, Dohan M, O'Connor L, Parks V. *Homeward Bound: Food-Related Transportation Strategies for Low Income and Transit Dependent Communities*. Los Angeles, Calif: University of California Transportation Center; 1996. Available at: <http://www.foodsecurity.org/homewardbound.pdf>. Accessed February 13, 2004.

87. Cohen HW, Northridge ME. Getting political: racism and urban health. *Am J Public Health*. 2000;90:841–842.



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