

# Food shopping behaviours and exposure to discrimination

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## Abstract

*Objective:* The present study examined food shopping behaviours, particularly distance to grocery shop, and exposure to discrimination.

*Design:* Cross-sectional observational study utilizing data from a community survey, neighbourhood food environment observations and the decennial census.

*Setting:* Three communities in Detroit, Michigan, USA.

*Subjects:* Probability sample of 919 African-American, Latino and white adults in 146 census blocks and sixty-nine census block groups.

*Results:* On average, respondents shopped for groceries 3·1 miles (4·99 km) from home, with 30·9% shopping within 1 mile (1·61 km) and 22·3% shopping more than 5 miles (8·05 km) from home. Longer distance to shop was associated with being younger, African-American (compared with Latino), a woman, higher socio-economic status, lower satisfaction with the neighbourhood food environment, and living in a neighbourhood with higher poverty, without a large grocery store and further from the nearest supermarket. African-Americans and those with the lowest incomes were particularly likely to report unfair treatment at food outlets. Each mile (1·61 km) increase in distance to shop was associated with a 7% increase in the odds of unfair treatment; this relationship did not differ by race/ethnicity.

*Conclusions:* The study suggests that unfair treatment in retail interactions warrants investigation as a pathway by which restricted neighbourhood food environments and food shopping behaviours may adversely affect health and contribute to health disparities. Efforts to promote 'healthy' and equitable food environments should emphasize local availability and affordability of a range of healthy food products, as well as fair treatment while shopping regardless of race/ethnicity or socio-economic status.

**Keywords**  
Food shopping  
Neighbourhood food environment  
Discrimination  
Distance to shop

Research in the USA has documented restricted food environments in racial/ethnic minority and low-income neighbourhoods compared with white and higher-income neighbourhoods<sup>(1,2)</sup>. Findings outside the USA are more equivocal<sup>(1–3)</sup>. Most research has tested whether those residing in restricted food environments, or 'food deserts', have poorer diet or weight outcomes than those in neighbourhoods with more supportive food environments<sup>(2)</sup>, assuming that individuals shop for groceries in their immediate neighbourhood and that inadequate availability of healthy foods in the immediate neighbourhood is a barrier to healthy eating. Yet, relatively little is known about food shopping behaviours, including how far individuals travel to shop<sup>(4,5)</sup>. Food shopping behaviours might not only affect food purchasing and dietary intakes, but also expose individuals – particularly racial/ethnic minorities – to discrimination. In racially/ethnically and economically segregated cities, by increasing interactions with store owners and employees who have less experience with

clientele who are racial/ethnic minorities or of lower socio-economic status<sup>(6)</sup>, shopping further from home may increase the risk that racial/ethnic minorities experience unfair treatment while shopping. The present study examined distance to grocery shop in relation to neighbourhood racial/ethnic composition and poverty, the neighbourhood food environment and individual-level factors; determined associations between distance to shop and other factors with exposure to unfair treatment at food outlets; and tested whether relationships between distance to shop and unfair treatment differed by race/ethnicity.

## Background

### *Distance to grocery shop*

Growing research across multiple countries shows that a sizeable proportion of individuals, as high as 90%, shop for at least some of their food beyond their immediate

residential neighbourhood<sup>(7–13)</sup>. Conceptual models of food access suggest that food purchasing and dietary behaviours are shaped by individual-level factors (e.g. transportation, income) and the neighbourhood food environment<sup>(14–17)</sup>. The neighbourhood food environment includes the location of food outlets and features of these outlets, such as food selection, food prices, cleanliness and service<sup>(14,16,17)</sup>. Individual-level factors and the neighbourhood food environment are posited to affect utilization of the food environment ('realized access'<sup>(17)</sup>; e.g. food shopping and purchasing) and, in turn, diet and health. While research has documented associations between the neighbourhood food environment and diet<sup>(2,18)</sup>, few studies have directly examined the extent to which individual-level factors and the neighbourhood food environment influence shopping behaviours. This is particularly important to understand among residents of neighbourhoods with restricted food environments. We discuss this literature below.

#### *Individual-level factors*

There is limited evidence that individual resources influence the ability to reach food stores beyond the neighbourhood. In a Detroit study of African-American women living in a community with a restricted food environment, those with higher education were more likely to shop in the suburbs compared with those having lower education, but there was no relationship between income or age and store location<sup>(8)</sup>. In bivariate analyses, Inagami and colleagues found that greater proportions of those who shopped beyond their neighbouring census tracts owned a car and were college-educated compared with those who shopped in the immediate census tract<sup>(13)</sup>. The mean income was also higher among those who shopped beyond their neighbourhood census tracts. Furthermore, in that study, 13% of Asians and 15% of African-Americans shopped in their immediate census tract compared with 23% of Latinos and whites. Forty-five per cent of African-Americans shopped beyond their neighbouring census tracts, compared with 34–38% of the other three groups. The authors conjectured this was related to restricted food environments in neighbourhoods where African-Americans lived.

#### *Neighbourhood food environment*

The neighbourhood food environment may affect food shopping behaviours. US research documents restricted food environments in low-income and predominantly African-American neighbourhoods<sup>(19–25)</sup>. Evidence of inequalities is less consistent in other countries<sup>(1,3)</sup>. Individuals living in neighbourhoods without a supermarket or large grocery store or foods they prefer and can afford may travel beyond their neighbourhood in order to frequent these store types and obtain desired foods<sup>(9,12)</sup>. It is plausible that availability of other store types also plays a role. For example, women have described safety concerns, caused in part by nearby liquor stores, as a deterrent to neighbourhood food shopping<sup>(9)</sup>.

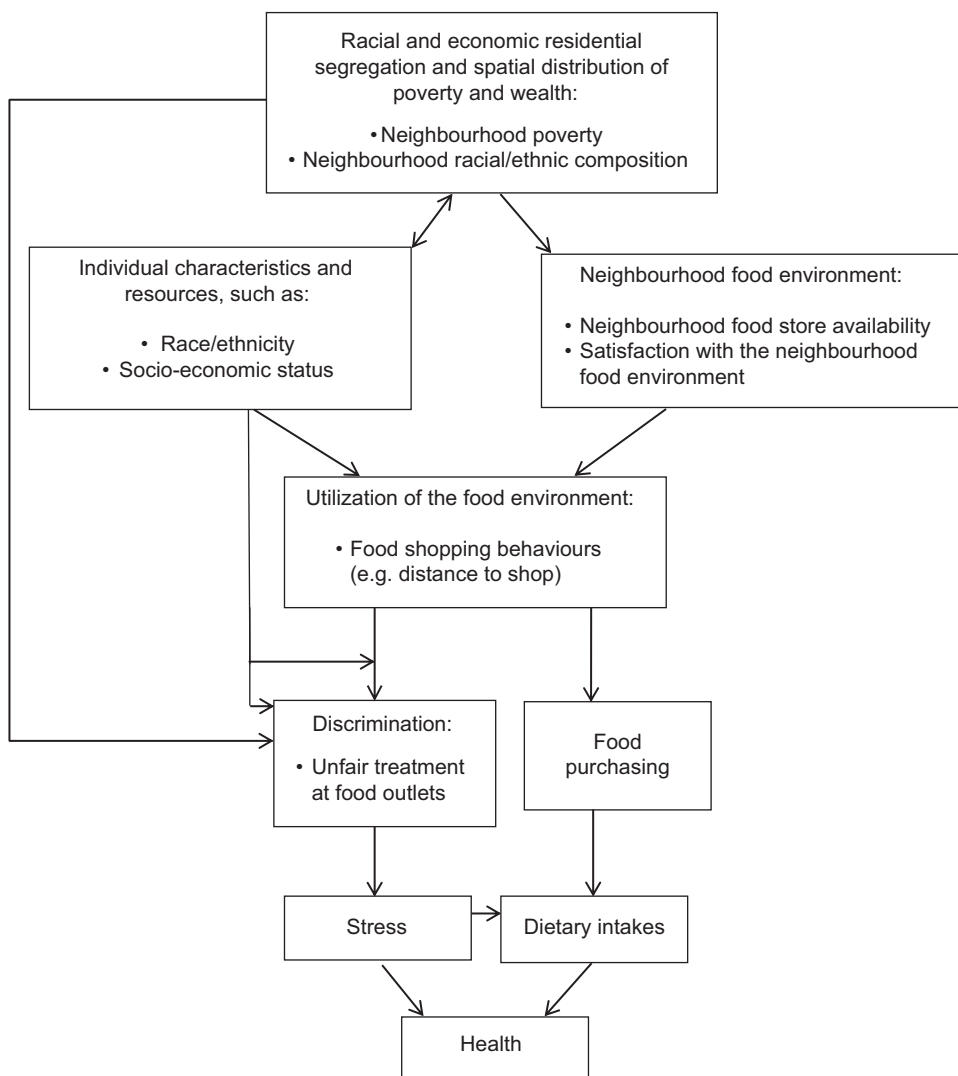
#### ***Discrimination while shopping***

Although not frequently discussed in conceptual models of food access, other research highlights how food shopping behaviours can expose individuals, particularly racial/ethnic minorities, to discrimination. Stores – food and non-food – are a common setting where racial/ethnic minorities in multiple countries encounter discrimination or unfair treatment because of their race/ethnicity<sup>(26–29)</sup>. In the USA, African-Americans and Latinos have described being watched, followed, and treated with less courtesy or respect than others while shopping<sup>(6,9,27,29,30)</sup>. While it may increase food access, shopping outside the residential neighbourhood may increase racial/ethnic minorities' exposure to discrimination. A study of general shopping behaviours of African-Americans in New York and Philadelphia, for example, found that participants were more likely to report discrimination while shopping in white neighbourhoods compared with the predominantly African-American neighbourhoods where they lived<sup>(6)</sup>. A sample of Latinas in Detroit described more experiences of discrimination when participating in daily activities outside their residential neighbourhood<sup>(31)</sup>. Thus, having to travel outside the neighbourhood to reach grocery stores or to avoid neighbourhood stores may expose individuals – particularly racial/ethnic minorities – to unfair treatment.

#### ***Conceptual model and research questions***

A conceptual model of food access, adapted from Sharkey's food access model<sup>(17)</sup> and other work<sup>(6)</sup> to more directly incorporate discrimination as a pathway by which the neighbourhood food environment and food shopping behaviours may affect health and contribute to health disparities, guides the present study (Fig. 1). This model recognizes that neighbourhood food environments are fundamentally shaped by processes of racial/ethnic and economic residential segregation and the spatial distribution of poverty and wealth in many societies<sup>(19,32,33)</sup>. Following Sharkey<sup>(17)</sup>, the neighbourhood food environment and individual-level factors affect utilization of the food environment or food shopping behaviours such as distance travelled, store type, store location and shopping frequency. Utilization influences health through multiple pathways, including food purchases and dietary intakes, as well as exposure to discrimination and resultant stress, which have been linked to poorer mental and physical health<sup>(34)</sup>. Implications of racial/ethnic and economic segregation for the distribution of food and other resources and discrimination while shopping have received the most attention in the USA. However, these are concerns in many societies<sup>(35–40)</sup>. We test aspects of this model here, focusing on three research questions:

1. Are neighbourhood racial/ethnic composition and poverty, the neighbourhood food environment and individual-level factors associated with distance to shop?



**Fig. 1** Conceptual model of multiple pathways by which the neighbourhood food environment may affect health. While not depicted here, the relationship between utilization of the food environment and discrimination may be bidirectional, with experiences of discrimination also affecting utilization of the food environment

2. Are race/ethnicity and distance to shop associated with unfair treatment at food outlets?
3. Does race/ethnicity moderate the relationship between distance to shop and unfair treatment?

**Methods**

**Sample**

Data were drawn from a 2002–2003 cross-sectional community survey of adults living in east-side, south-west and north-west Detroit conducted by the Detroit Healthy Environments Partnership, a community-based participatory research partnership made up of community-based organizations, health service providers and academic researchers<sup>(41)</sup>. At the time that data were collected, approximately 80% of Detroit residents were African-American while 80%

of residents in the surrounding metropolitan area were white, and only nine full-service chain supermarkets or supercentres were located in Detroit, a city with a population of 950 000 people and that covers 139 sq miles (360 km<sup>2</sup>)<sup>(19)</sup>. A stratified proportional probability sample design was used to achieve variation in socio-economic status within each of three predominant racial/ethnic groups: African-American, Latino and white. A total of 919 adults aged ≥25 years completed the survey in English or Spanish for an overall response rate of 55% (number of completed interviews from the number of households in the sample estimated to have an eligible respondent). Interviews were completed with 75% of households in which an eligible respondent was identified and with 90% of households in which an eligible respondent was contacted. The study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures

involving human subjects were approved by the University of Michigan Institutional Review Board for Protection of Human Subjects. Written informed consent was obtained from each survey respondent.

### **Measures**

#### *Food shopping behaviours*

We measured three food shopping behaviours: (i) distance to grocery shop; (ii) store type; and (iii) store location. Respondents were asked the name, closest street intersection and city of the store where they shopped for most of their groceries. Based on this information, stores were identified using telephone directories, company websites and other Internet searches, and classified by type (chain full-service supermarket or supercentre, other food store) and location (Detroit city, suburbs). We geocoded stores using the mapping software ArcGIS 9.1 and calculated the street-network distance from the centroid (geometric centre) of respondents' residential census block to the store where shopped. Census block centroids are good proxies for locations of participants' homes due to the small size of census blocks in the sample (median = 0.009 sq miles (0.023 km<sup>2</sup>); minimum = 0.001 sq miles (0.003 km<sup>2</sup>), maximum = 0.038 sq miles (0.098 km<sup>2</sup>)).

#### *Unfair treatment at food outlets*

Unfair treatment at food outlets was assessed via respondent self-report on a single item: 'How often (over the previous 12 months) did you receive poorer treatment than other people at restaurants or stores?' (1 = never, 5 = almost always)<sup>(42)</sup>. Because of the skewed distribution, responses were dichotomized as never or almost never (0) and sometimes, often or almost always (1).

#### *Neighbourhood racial/ethnic composition and poverty*

Using 2000 decennial census data, census block groups were categorized by racial/ethnic composition as predominantly African-American (>80% African-American residents) or other ( $\leq$ 80% African-American) and by poverty level as low poverty (<20% residents with incomes below federal poverty line), moderately poor (20–40%) or high poverty (>40%)<sup>(43)</sup>. Census block groups are the smallest geography for which economic data are publicly available.

#### *Neighbourhood food environment*

We measured two aspects of the neighbourhood food environment: (i) food store availability; and (ii) satisfaction with the neighbourhood food environment. Data on neighbourhood food store availability were drawn from a 2002 mapping of food stores (based on data from the Michigan Department of Agriculture and field observations)<sup>(20)</sup>. With regard to the food environment, neighbourhood was defined as a 0.5-mile (0.80-km) radial buffer around respondents' residential census block

centroids. Commonly used in prior neighbourhood food environment research<sup>(44)</sup>, a 0.5-mile buffer was selected to capture the food environment in close proximity to respondents' homes. While the Michigan Department of Agriculture data provided names and addresses of stores selling food, it did not provide information on store type. Thus, we used name recognition and observational data for store classification. Stores were categorized as large grocery stores (non-chain with at least three cash registers), small grocery stores (non-chain with one or two cash registers), convenience stores without gasoline stations (limited capacity for customer check-out, but not a produce, meat or seafood market), liquor store ('liquor' store in the telephone directory; 'liquor' or 'party' in name; or 'liquor', 'beer' or 'wine' as largest sign on storefront) and specialty store (produce, meat or seafood as primary food product). These definitions are similar to those used in prior studies that relied at least partially on store name and observation for store classification<sup>(45,46)</sup>. For large grocery stores, small grocery stores and convenience stores, availability was included as a dichotomous indicator (presence *v.* absence). Liquor store availability was included as a count due to the large number of liquor stores in the study neighbourhoods<sup>(20)</sup>. Because of the small number of supermarkets in the city of Detroit<sup>(19)</sup>, we included supermarket availability as the street-network distance from the census block centroid to the nearest supermarket (chain full-service supermarket or supercentre), calculated using ArcGIS Network Analyst 9.1.

Satisfaction with the neighbourhood food environment was measured via respondent self-report with seven items (4 = very satisfied, 1 = not at all satisfied). For these items, participants were asked to think about stores within a 10–15 min walk or a 5 min drive from home, including grocery stores, convenience stores and other places they might buy food. Representative items included 'variety of fruits and vegetables', 'cost and affordability of fresh fruits and vegetables', 'quality of fresh meats' and 'cleanliness'. Mean scores were calculated, with higher scores corresponding with greater satisfaction ( $\alpha = 0.92$ ).

#### *Individual-level factors*

Based on self-reported race and ethnicity, respondents were grouped as non-Hispanic African-American, non-Hispanic white, Latino and other. Other demographic variables were gender; age in years; marital status; and five indicators of individual or household socio-economic position, namely education, employment, annual per capita household income, automobile ownership and home ownership. We also measured length of residence in Detroit.

### **Data analysis**

Multiple imputation procedures derived from Bayesian models were used to impute missing survey values using the IVEware imputation and variance estimation software<sup>(47)</sup>. Descriptive statistics weighted to reflect the racial/ethnic

and socio-economic characteristics of the three study communities were computed to describe sample demographic characteristics, food shopping behaviours and neighbourhood characteristics using the statistical software package SAS version 9.1 (2002–2003). Correlations among relevant predictors were calculated to identify possible collinearities. Three-level linear and non-linear hierarchical models with robust standard errors were estimated using the software HLM 7 (2011). Level 1 was the 919 survey respondents; level 2 was the 146 census blocks in which respondents resided plus the 0.5-mile (0.80-km) radial buffers; and level 3 was the sixty-nine census block groups.

To address the first research question, we estimated three regression models. In Model 1, we performed the regression of distance to shop *v.* individual-level factors, neighbourhood racial/ethnic composition and neighbourhood poverty. In Model 2, we added neighbourhood food store availability. In Model 3, we added satisfaction with the neighbourhood food environment. To address the second research question, we performed the regression of unfair treatment at food outlets *v.* individual-level factors (including race/ethnicity), distance to shop, neighbourhood racial/ethnic composition and neighbourhood poverty. The third research question was addressed through the addition of multiplicative interaction terms between each individual race/ethnicity dummy variable and distance to shop.

## Results

Table 1 shows weighted descriptive statistics for the individual- and neighbourhood-level variables. On average, respondents most often shopped for groceries 3.1 miles (4.99 km) from home (Table 1), with 30.9% shopping within 1 mile (1.61 km), 53.9% within 2 miles (3.22 km) and 77.7% within 5 miles (8.05 km; data not shown). Thirty-five per cent of respondents reported that they most often shopped at a supermarket; 65% shopped at another store type. Most respondents (70.6%) shopped in the city of Detroit, with the remainder shopping most often in the suburbs. There were significant associations among distance to shop, store type and store location. Supermarket shoppers averaged 5.7 miles (9.17 km) to shop, compared with 1.8 miles (2.90 km) for those shopping at another store type ( $P < 0.001$ ). Those shopping in the suburbs averaged 6.7 miles (10.78 km) compared with 1.7 miles (2.74 km) for those shopping in Detroit ( $P < 0.001$ ). Seventy-six per cent of respondents who shopped in the suburbs frequented a supermarket; 81.7% of those who shopped in Detroit frequented another store type.

Table 2, Model 1 shows the results of the multilevel regression model for distance to shop and individual-level factors, neighbourhood racial/ethnic composition

**Table 1** Weighted descriptive statistics for individual- and neighbourhood-level variables

Variable	Value	SE
Individual (Level 1; <i>n</i> 919 respondents)		
Distance to store where shop (miles), mean	3.1	0.1
Store type (%)		
Supermarket	35.1	
Other store type	64.9	
Store location (%)		
City of Detroit	70.6	
Suburbs	29.4	
Unfair treatment at restaurants and stores (% yes)	23.7	
Satisfaction with neighbourhood food environment	2.8	<0.1
Gender (% female)	52.3	
Race/ethnicity (%)		
African-American	56.8	
Latino	22.2	
White	18.8	
Other	2.3	
Marital status (% currently married)	26.4	
Education (%)		
<High school or GED diploma	36.9	
High-school graduate or GED diploma	29.1	
>High school	32.8	
Employment (% currently employed)	69.6	
Annual household income per capita (%)		
<\$US 4500	25.1	
\$US 4500–7499	27.4	
\$US 7500–16 200	25.2	
>\$US 16 200	22.3	
Automobile ownership (% yes)	67.0	
Home ownership (% yes)	48.5	
Age (years), mean	46.3	0.8
Length of residence in Detroit (years), mean	33.6	0.8
Neighbourhood (Level 2; <i>n</i> 146 census blocks)		
Large grocery store (%)	39.2	
Small grocery store (%)	33.8	
Convenience store (%)	25.4	
Specialty store (%)	32.2	
Liquor store (mean number)	5.43	0.2
Supermarket, mean distance to nearest (miles)	3.27	0.1
Neighbourhood (Level 3; <i>n</i> 69 census block groups)		
Racial/ethnic composition (%)		
Predominantly African-American (>80%)	53.5	
Other (≤80% African-American)	46.5	
Poverty level (%)		
Low poverty (<20% below poverty)	13.1	
Moderately poor (20–40% below poverty)	53.7	
High poverty (>40% below poverty)	33.1	

GED, General Educational Development.  
1 mile = 1.61 km.

and neighbourhood poverty. Controlling for the other variables, on average, those who were younger, women, African-Americans (compared with Latinos), those educated beyond high school, automobile owners, those with higher incomes and those living longer in Detroit shopped further from home. Residing in moderately poor and high-poverty neighbourhoods was associated with a 0.71-mile (1.14-km) and 0.98-mile (1.58-km) increase in distance to shop, respectively, compared with residents of low-poverty neighbourhoods.

Models 2 and 3 add two aspects of the neighbourhood food environment: food store availability (Model 2) and satisfaction with the neighbourhood food environment (Model 3; Table 2). Controlling for the individual-level variables, neighbourhood racial/ethnic composition and neighbourhood poverty, presence of a large grocery store

**Table 2** Multilevel regression results of the associations of individual-level factors, neighbourhood poverty and neighbourhood food environment with distance to grocery shop (miles)

Variable†	Model 1			Model 2			Model 3		
	Estimate	SE	P	Estimate	SE	P	Estimate	SE	P
<b>Individual</b>									
Age	-0.02	0.01	*	-0.02	0.01	*	-0.01	0.01	
Gender (Ref: Male)									
Female	0.81	0.24	*	0.83	0.25	**	0.76	0.24	**
Race/ethnicity (Ref: African-American)‡									
Latino	-0.74	0.35	*	-0.59	0.48		-0.30	0.47	
White	0.11	0.35		0.15	0.37		0.16	0.38	
Marital status (Ref: Not currently married)									
Currently married	0.01	0.28		<0.01	0.29		0.06	0.27	
Education (Ref: <High school or GED diploma)									
High-school graduate or GED diploma	0.07	0.29		0.13	0.30		0.10	0.30	
>High school	1.02	0.32	*	1.11	0.33	**	0.87	0.31	*
Employment (Ref: Not currently employed)									
Currently employed	-0.21	0.29		-0.22	0.28		-0.06	0.30	
Annual household income per capita (Ref: <\$US 4500)									
\$US 4500–7499	-0.03	0.25		0.05	0.25		-0.14	0.26	
\$US 7500–16 200	0.71	0.27	**	0.73	0.28	**	0.72	0.28	**
>\$US 16 200	0.67	0.46		0.73	0.46		0.59	0.42	
Automobile ownership (Ref: No)									
Owns automobile	1.11	0.28	***	1.17	0.28	***	1.08	0.27	***
Home ownership (Ref: No)									
Owns home	-0.29	0.29		-0.34	0.29		-0.17	0.28	
Length of residence in Detroit	0.02	0.01	*	0.02	0.01	*	0.02	0.01	*
Satisfaction with the neighbourhood food environment							-1.08	0.14	***
<b>Neighbourhood/census block</b>									
Large grocery store				-0.72	0.23	**	-0.70	0.21	**
Small grocery store				-0.28	0.26		-0.18	0.24	
Convenience store				0.22	0.24		0.25	0.23	
Specialty store				-0.14	0.28		-0.05	0.26	
Liquor store, number				-0.05	0.05		-0.04	0.05	
Supermarket, distance to nearest (miles)				0.39	0.19	*	0.21	0.16	
<b>Neighbourhood/census block group</b>									
Racial/ethnic composition (Ref: Other)									
Predominantly African-American	-0.08	0.33		0.02	0.38		-0.22	0.35	
Poverty level (Ref: Low poverty)									
Moderately poor	0.71	0.34	*	0.75	0.25	**	0.88	0.21	***
High poverty	0.98	0.48	*	0.85	0.42	*	0.88	0.38	*

Ref., reference category; GED, General Educational Development.

1 mile = 1.61 km.

\**P* < 0.05, \*\**P* < 0.01, \*\*\**P* < 0.001.

†All individual-level variables are grand-mean centred. Number of liquor stores and distance to the nearest supermarket at the census block level are also grand-mean centred.

‡Other race/ethnicity not shown due to small sample size.

in the neighbourhood was associated with an average decrease of 0.72 miles (1.16 km) in distance to shop (Model 2). Each 1-mile (1.61-km) increase in distance to the nearest supermarket was associated with a 0.39-mile (0.63-km) increase in distance to shop. Availability of a small grocery store, convenience store, specialty store and a greater number of liquor stores in the neighbourhood were not associated with distance to shop. Addition of neighbourhood food store availability reduced the magnitude of the coefficient for Latino (compared with African-American) by 20% to non-significance. Controlling for the individual-level variables, neighbourhood racial/ethnic composition and poverty, and neighbourhood food store availability, each unit increase in satisfaction with the neighbourhood food environment was associated with a 1.1-mile (1.77-km) decrease in distance to shop (Model 3; Table 2). Addition of this variable to the model reduced the magnitude of the

coefficients for distance to a supermarket by 46% to non-significance and by 49% for Latino (compared with African-American).

Table 3, Model 1 shows the results of the multilevel regression model for unfair treatment at food outlets and individual-level factors, distance to shop, neighbourhood racial/ethnic composition and neighbourhood poverty. Whites and Latinos were, respectively, 45% and 61% less likely than African-Americans to report unfair treatment at the places they frequented. Those with the highest income were 58% less likely to report unfair treatment than those with the lowest income. Each mile (1.61-km) increase in the distance to shop was associated with a 7% increase in the odds of unfair treatment.

Table 3, Model 2 adds interaction terms between race/ethnicity and distance to shop, which were not statistically significant.

**Table 3** Multilevel regression results of the associations of individual-level factors, neighbourhood poverty and distance to grocery shop with unfair treatment at food outlets

Variable	Model 1			Model 2		
	OR	95% CI	P	OR	95% CI	P
<b>Individual†</b>						
Age	0.99	0.97, 1.01		0.99	0.97, 1.01	
Gender (Ref: Male)						
Female	0.65	0.42, 1.01		0.64	0.41, 1.01	
Race/ethnicity (Ref: African-American)‡						
Latino	0.39	0.17, 0.92	*	0.35	0.12, 1.04	
White	0.55	0.32, 0.93	*	0.50	0.22, 1.12	
Marital status (Ref: Not currently married)						
Currently married	0.73	0.41, 1.30		0.72	0.41, 1.28	
Education (Ref: <High school or GED diploma)						
High-school graduate or GED diploma	0.94	0.55, 1.61		0.92	0.54, 1.58	
>High school	0.66	0.35, 1.25		0.64	0.34, 1.22	
Employment (Ref: Not currently employed)						
Currently employed	1.22	0.79, 1.88		1.22	0.79, 1.89	
Annual household income per capita (Ref: <\$US 4500)						
\$US 4500–7499	0.68	0.34, 1.35		0.67	0.34, 1.34	
\$US 7500–16200	0.92	0.43, 1.97		0.94	0.45, 1.95	
>\$US 16200	0.42	0.21, 0.84	*	0.43	0.22, 0.85	*
Automobile ownership (Ref: No)						
Owns automobile	1.08	0.70, 1.66		1.06	0.69, 1.63	
Home ownership (Ref: No)						
Owns home	0.83	0.55, 1.25		0.84	0.55, 1.28	
Length of residence in Detroit	1.00	0.98, 1.02		0.99	0.97, 1.02	
Distance to grocery shop	1.07	1.00, 1.13	*	1.05	0.97, 1.04	
Latino × distance to grocery shop				1.03	0.88, 1.19	
White × distance to grocery shop				1.02	0.86, 1.21	
<b>Neighbourhood/census block group</b>						
Racial/ethnic composition (Ref: Other)						
Predominantly African-American	0.87	0.48, 1.56		0.85	0.47, 1.54	
Poverty level (Ref: Low poverty)						
Moderately poor	0.66	0.40, 1.07		0.62	0.37, 1.12	
High poverty	0.70	0.40, 1.21		0.69	0.39, 1.24	

Ref., reference category; GED, General Educational Development.  
 \* $P < 0.05$ , \*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ .

†All individual-level variables are grand-mean centred.

‡Other race/ethnicity not shown due to small sample size.

### Discussion

The present study tested three research questions related to food shopping behaviours and exposure to unfair treatment, grounded in the conceptual model described above, in a multiethnic urban sample. Like reported in a limited number of prior studies conducted in the USA<sup>(7,13)</sup>, proportionately few individuals shopped in their immediate residential neighbourhood and many shopped at a considerable distance from home. Extending prior work we found not only that those with more individual resources (e.g. higher incomes, automobiles), but also those living in neighbourhoods with restricted food environments, were more likely to shop further from home. Shopping further from home, however, increased the likelihood of being treated unfairly. African-Americans were more likely to report unfair treatment at food outlets than Latinos and whites, regardless of how far they shopped from home.

#### Distance to grocery shop

Consistent with conceptual models of food access, both individual- and neighbourhood-level resources were

correlated with distance to grocery shop. Similar to Inagami *et al.*<sup>(13)</sup>, we found that individuals with greater socio-economic resources (e.g. income, education, automobile) shopped further from home than those with fewer socio-economic resources. Those with more resources may have greater mobility, higher expectations with respect to food quality and options, or larger activity spaces that expose them to alternative grocery stores through their daily activities<sup>(48,49)</sup>. That length of city residence was positively associated with distance to grocery shop may suggest a well-established adaptive strategy to living in an area with a restricted food environment<sup>(9)</sup>.

Consistent with Inagami and colleagues' findings<sup>(13)</sup>, African-Americans travelled further than Latinos to shop. Moreover, the neighbourhood food environment explained the difference in distance to shop between African-Americans and Latinos. Most Latinos in Detroit, including in our sample, live in a single ethnic enclave on the south-west side. It is possible that stores in south-west Detroit and other ethnic enclaves meet the needs (e.g. cultural foods, Spanish-speaking employees) of Latino clientele better than stores located near African-Americans

meet their needs. For example, a study in Chicago, another segregated context like Detroit, found that Latino culturally specific fruits and vegetables were more prevalent at stores located in predominantly Latino neighbourhoods than were African-American culturally specific items at stores in predominantly African-American neighbourhoods<sup>(50)</sup>.

Like Chaix and colleagues who found in Paris, France that individuals who lived in neighbourhoods with a low average education level shopped further from home than those with the highest average education level<sup>(11)</sup>, we found that individuals living in higher-poverty neighbourhoods travelled further to shop. Extending a prior study of low-income, predominantly minority shoppers in Philadelphia that found distance to a supermarket was positively associated with distance to shop<sup>(12)</sup>, we found that residents of neighbourhoods without a large grocery store and located at a greater distance from a supermarket shopped further from home. Furthermore, those who were more satisfied with the neighbourhood food environment shopped closer to home, independent of automobile ownership and other individual-level demographics. These findings suggest that individuals living in neighbourhoods with inadequate food resources may indeed be forced to shop outside their neighbourhood<sup>(9,12,13)</sup>. Some research in multiple countries has found that longer distance to shop is associated with a higher BMI, possibly due to less frequent shopping, purchasing more bulk foods, running out of fresh foods such as fresh fruits and vegetables, or reallocating funds that might be used to purchase healthy food in order to reach distant food sources<sup>(11,13)</sup>.

### ***Discrimination while shopping***

Findings regarding discrimination at food outlets are an important contribution of the present study. African-Americans and low-income individuals were particularly likely to report unfair treatment at food outlets. In addition, those who shopped further from home were more likely to report unfair treatment at food outlets. Of note, this relationship was specific to the single-item measure of unfair treatment at food outlets and did not hold when a five-item unfair treatment measure (which included people act as if you they think you are not smart, act as if they are afraid of you, treat you with less courtesy or respect, threaten or harass you) was used (data not shown)<sup>(42)</sup>. Moreover, this relationship did not differ by race/ethnicity. Nevertheless, because African-Americans are more likely to live in neighbourhoods with fewer food resources<sup>(19–25)</sup>, and models presented here suggest that they may shop further from home, African-Americans may be more negatively affected. Interestingly, when we substituted store location (suburb, city) for distance to shop in the model, there was no difference in the likelihood of unfair treatment between those shopping in the suburbs and those shopping in the city. Thus, exposure to unfair treatment was not confined to suburban settings. In Detroit, many food stores located in African-American

neighbourhoods are owned by individuals from other racial/ethnic groups who live outside the community and inter-racial/ethnic tensions between store owners and African-American clientele are documented<sup>(51–53)</sup>. This may contribute to African-Americans' perceptions of discrimination at food stores. Because individuals may avoid shopping at stores where they have been treated poorly<sup>(6)</sup>, discrimination at food outlets may increase the challenges they experience in obtaining food. Furthermore, as suggested by the conceptual model (Fig. 1), discrimination while shopping may have deleterious health effects (e.g. depressive symptoms, physiological stress responses)<sup>(34)</sup>. This warrants further research. Increasing local ownership of and employment at food outlets may help to alleviate perceived discrimination while shopping.

### ***Study limitations***

The study has several limitations. First, the cross-sectional design precludes us from establishing temporal ordering of variables. While we hypothesized that distance to shop would affect exposure to unfair treatment, we cannot rule out the possibility that unfair treatment at stores closer to home leads individuals to shop further away. Second, because of the wording of the single item we used to measure unfair treatment, 'poorer treatment than other people at restaurants or stores', it is possible that responses may apply to restaurants or to non-food stores. Third, while qualitative studies have suggested that racial/ethnic minorities who shop in predominantly racial/ethnic majority neighbourhoods encounter more discrimination than those shopping in neighbourhoods whose demographic characteristics more closely match their own<sup>(6)</sup>, it is unclear from the results reported here whether frequenting stores in which the race/ethnicity of employees or demographic or economic characteristics of the neighbourhoods differed from that of the shopper contributed to experiences of unfair treatment. Future studies that explicitly test these hypotheses in the USA and other countries would help to better understand the patterning of exposure to discrimination while shopping.

### ***Conclusions***

Study findings suggest that the neighbourhood food environment, along with individual-level resources, affect food shopping behaviours. In the USA, African-Americans may be disproportionately affected by these processes due to the characteristics of the neighbourhoods in which they are more likely to reside. Those who shop further from home, regardless of race/ethnicity, may be disproportionately exposed to discrimination while shopping. Future studies could illuminate the extent to which the patterns for racial/ethnic minorities and distance to shop hold in other US contexts and countries. Furthermore,



research is warranted to explore interpersonal discrimination as another pathway by which food shopping behaviours and indirectly the neighbourhood food environment affect health and contribute to health disparities. Efforts to promote 'healthy' and equitable food environments should emphasize local availability and affordability of a range of healthy food products, as well as fair treatment regardless of race/ethnicity or socioeconomic status.

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