

Assessing the relevance of neighbourhood characteristics to the household food security of low-income Toronto families

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Abstract

Objective: Although the sociodemographic characteristics of food-insecure households have been well documented, there has been little examination of neighbourhood characteristics in relation to this problem. In the present study we examined the association between household food security and neighbourhood features including geographic food access and perceived neighbourhood social capital.

Design: Cross-sectional survey and mapping of discount supermarkets and community food programmes.

Setting: Twelve high-poverty neighbourhoods in Toronto, Ontario, Canada.

Subjects: Respondents from 484 low-income families who had children and who lived in rental accommodations.

Results: Food insecurity was pervasive, affecting two-thirds of families with about a quarter categorized as severely food insecure, indicative of food deprivation. Food insecurity was associated with household factors including income and income source. However, food security did not appear to be mitigated by proximity to food retail or community food programmes, and high rates of food insecurity were observed in neighbourhoods with good geographic food access. While low perceived neighbourhood social capital was associated with higher odds of food insecurity, this effect did not persist once we accounted for household sociodemographic factors.

Conclusions: Our findings raise questions about the extent to which neighbourhood-level interventions to improve factors such as food access or social cohesion can mitigate problems of food insecurity that are rooted in resource constraints. In contrast, the results reinforce the importance of household-level characteristics and highlight the need for interventions to address the financial constraints that underlie problems of food insecurity.

Keywords
Food insecurity
Neighbourhoods
Local area food access
Social capital

Food insecurity – inadequate or insecure access to food in the context of financial constraints – is recognized as a serious public health problem in many affluent countries^(1–5). In Canada, an estimated 1.1 million households (9.2%) were food insecure in 2004⁽¹⁾. Although the sociodemographic characteristics of food-insecure households have been well documented through analyses of population health survey data^(1,6–8), there has been little examination of neighbourhood characteristics in relation to this problem. However, the existing literature points to two routes through which neighbourhood might influence vulnerability to food insecurity: (i) the local area food environment; and (ii) neighbourhood social capital.

The neighbourhood that one occupies confers advantages and disadvantages of location, including features of

the local area food environment. Disparities in food access in relation to socio-economic indicators, as well as deprived areas with poor access to healthy affordable food (often referred to as ‘food deserts’), have been documented in both the USA and the UK^(9–12). Interestingly though, research in the UK also suggests that food retail access varies considerably between low-income neighbourhoods, with some neighbourhoods having ample retail outlets⁽¹³⁾. This observation is borne out in the findings of existing Canadian research^(14–18). For example, a recent study conducted in Montréal examined access to supermarkets in relation to neighbourhood social deprivation and found little evidence of food deserts⁽¹⁴⁾. The authors of a study conducted in London, Ontario, however, concluded that low-income areas in inner-city neighbourhoods have the poorest access to

supermarkets by walking, although there was good access by public transportation⁽¹⁵⁾. These studies did not assess the association between contextual features of neighbourhoods and household-level food purchasing or consumption.

US research has documented associations between fruit and vegetable consumption and objective measures of supermarket access^(19–21). Subjective assessments of the local food environment may also be pertinent, with a recent Australian study showing associations between perceptions of local food availability, accessibility and affordability and frequency of fruit, vegetable and fast-food consumption among women⁽²²⁾. However, studies conducted in Australia and Europe have raised debate about the extent to which food retail access affects food purchasing and consumption once household socio-economic status is taken into account^(23–25), and it is not known whether convenient access to food retail can offset problems of food insecurity rooted in resource constraints.

Further, in many Canadian communities, there is now a myriad of local programmes to help offset problems of household food security. These include charitable food assistance programmes (e.g. 'food banks'), community kitchens and community gardens^(26–28). Although such initiatives tend to be located in low-income neighbourhoods and may be indicative of the level of poverty-related services available to residents, the relevance of proximity to these programmes to household food security status is not known.

In addition to access to amenities, it has been postulated that neighbourhood social capital, referring to perceptions of social cohesion and trust in one's community, may be predictive of household food security status^(29,30). The observed associations between perceived neighbourhood social capital and indicators of food insecurity in US studies of low-income households^(29,30) are consistent with research highlighting the social isolation that characterizes experiences of food insecurity^(31–33). While social capital has been linked to health more broadly in other studies^(34,35), it has also been postulated that socio-economic factors are of greater relevance to health^(36,37) and that low social capital may be an outcome of macro-level conditions that also lead to poor health rather than being a pathway to poor health⁽³⁸⁾. Further research is needed to determine the relevance of social capital to food security.

We undertook a study of low-income families in Toronto, Canada, employing survey methods, mapping of neighbourhood food access and in-depth qualitative interviewing, to gain an understanding of factors associated with household food security. We have previously reported rates of food insecurity and participation in community programmes among this sample⁽³⁹⁾. The objectives of the current paper are to examine the association between household food security and (i) geographic access to food retail and food programmes and (ii) perceived neighbour-

hood social capital, drawing upon the survey and neighbourhood mapping data. Given the high levels of deprivation in the sample, we examine neighbourhood characteristics in relation to measures of food insecurity and also severe food insecurity.

Methods

Sampling and data collection

Data were collected between November 2005 and January 2007. The study protocol was approved by the Human Subjects Research Ethics Board at the University of Toronto. Families with children and who were tenants were studied because of the association between these household characteristics and vulnerability to problems of food insecurity⁽¹⁾. Families were recruited from twelve high-poverty neighbourhoods (census tracts) randomly selected from twenty-three where more than 40% of families had low incomes according to the 2001 Census⁽⁴⁰⁾. The sample was stratified to include families living in market and subsidized rental units and potential respondents in each census tract were approached at the door by trained interviewers with personal experience of low income.

Respondents were eligible for inclusion if: (i) their household included at least one child 18 years of age or younger; (ii) they lived in rental accommodations and had lived in their current dwelling for at least one month; (iii) the potential respondent had sufficient fluency in English to complete an oral interview; and (iv) the gross household income was at or below an income threshold based on household size. The thresholds were \$CAN 29 999 for a family of two, \$CAN 39 999 for a family of three or four, and \$CAN 59 999 for a family of five or more⁽⁴¹⁾. These relatively generous thresholds, which are higher than welfare rates in the province of Ontario, were used to ensure that the sample encompassed both the 'working poor' and welfare recipients. In eligible households, the interviewers sought to conduct an in-home structured interview with the person who had primary responsibility for food shopping and management. The interview questionnaire was designed to elicit information on household sociodemographic characteristics, food security status, food shopping habits, use of community food programmes and neighbourhood social capital. Participants gave written consent after being informed about the study objectives and methods. A total of 501 families participated in the study, reflecting a participation rate of 62%. Seventeen families that were initially screened as eligible were found to have incomes that exceeded the eligibility threshold based on the detailed information collected during the interview and were excluded. The analytic sample thus includes 484 families.

Geographic Information Systems (GIS) software was used to map discount supermarkets in the City of Toronto as a proxy for access to a range of foods at reasonable prices (preliminary analysis indicated that over 80% of respondents did the majority of their food shopping at discount supermarkets). Data on the location (longitude and latitude) of discount supermarkets were obtained from the University of Toronto Map Library and cross-checked with a list obtained from the City of Toronto and Yellow Pages listings. We also mapped food banks, community gardens and community kitchens using data from programme providers. We focus on these programmes given that they are common community-based responses to food insecurity in Canada.

Measures

The Household Food Security Survey Module⁽⁴²⁾ was used to assess food security over the 12 months prior to families' participation in the study. Thresholds adopted by Health Canada were applied to categorize families as food secure or food insecure, indicative of compromises in the quality and/or quantity of food consumed by adults and/or children⁽¹⁾. A variable to distinguish families that were severely food insecure, indicative of reduced food intake and disrupted eating patterns, from more food-secure families was also created⁽¹⁾.

The distances from each household's dwelling to the nearest discount supermarket, food bank, community kitchen and community garden were calculated using ArcGIS (ESRI, Redlands, CA, USA). Since there is no standard threshold to demarcate adequate geographic food access, we explored associations between household food security and continuous distance variables as well as dichotomous variables based on thresholds of 1 km and 2 km. Additional measures related to the local area food environment were drawn from the survey and include perceived adequacy of food retail, whether families shopped within their neighbourhood, and transportation costs for a round trip to the supermarket.

To assess perceived neighbourhood social capital, we adopted the scale⁽⁴³⁾ used in previous food security research^(29,30). Respondents were asked whether they agreed (scored as 1) or disagreed (scored as 0) with each of seven statements, the items were summed to give a score ranging from 0 to 7 (two negatively worded items were reverse coded), and a threshold of 3 or lower was applied to indicate low social capital⁽³⁰⁾.

Statistical methods

Multilevel logistic modelling, using the PROC GLIMMIX macro in the SAS statistical software package version 9.1.3 (SAS Institute, Cary, NC, USA), was conducted to assess the relevance of household-level variables to food security while accounting for neighbourhood of residence⁽⁴⁴⁾. A random intercept null model was used to estimate the proportion of variation in food insecurity and

severe food insecurity at the neighbourhood level. We then added fixed effects for household sociodemographic characteristics to assess the extent to which variation in food insecurity across neighbourhoods is attributable to compositional effects. Sociodemographic characteristics included income from all sources over the past 12 months, the household's main source of income, household type, highest level of education obtained by the respondent, immigrant status of the respondent and his/her partner where applicable, the number of adults and number of children in the household, and whether the household lived in market or subsidized rental accommodations to account for the stratification of the sample. (The results of an examination of the associations between these characteristics and severe food insecurity have been published elsewhere⁽³⁹⁾ and so are only briefly summarized here.)

Models were then run including fixed effects for (i) neighbourhood food access variables and (ii) neighbourhood social capital, to examine the association between these factors and household food security. The models were repeated with household sociodemographic covariates included to account for their potential confounding effect. Because perceptions of neighbourhood cohesion might differ depending on the length of time that a family had lived in the neighbourhood, the social capital model also included a variable indicating the number of years in the current dwelling.

Finally, to shed further light on the relationship between neighbourhood food access and food security, we examined associations between proximity to discount supermarkets, perceived food retail access, cost of transportation for grocery shopping trips and household food security. Consistent with our analytic strategy, both unadjusted models and models including household sociodemographic covariates were run.

Results

The sample characteristics are outlined in Table 1. Two-thirds (65.3%) of families were food insecure and about a quarter (27.7%) were characterized as severely food insecure in the 12 months prior to their participation in the study. The prevalence of food insecurity varied across neighbourhoods (Table 2) but only 1% of the variation in food security and less than 1% of the variation in severe food insecurity was a function of neighbourhood of residence. Lower odds of household food insecurity were observed with increasing income and among families in which the household head and/or his/her partner were a recent immigrant to Canada, while families whose main source of income was welfare had higher odds of food insecurity (Table 1). Similarly, lower odds of severe food insecurity were observed with increasing income, whereas higher odds of severe food insecurity were apparent among households reliant on welfare, those headed by a lone

Table 1 Household food insecurity in relation to household sociodemographic characteristics among respondents (*n* 484) from low-income families who had children and who lived in rental accommodations, Toronto, Ontario, Canada, November 2005–January 2007

	Mean	SD	Adjusted OR of food insecurity*	95 % CI
Household income over past 12 months (\$CAN)	23 033	8963	0.97	0.95, 0.99
Number of adults	1.69	0.75	0.98	0.71, 1.35
Number of children	2.07	0.75	1.20	0.96, 1.48
	<i>n</i>	% of families		
Main source of income				
Employment	254	52.5	1.00	reference
Welfare	131	27.1	2.52	1.44, 4.43
Other sources [†]	99	20.5	1.50	0.82, 2.74
Household type				
Two-parent or lone-father [‡]	224	46.3	1.00	reference
Lone-mother	260	53.7	1.08	0.64, 1.82
Highest level of education attained by household respondent				
Less than high school graduation	109	22.5	1.02	0.60, 1.72
Completed high school	375	77.5	1.00	reference
Immigrant status [§]				
Born in Canada	85	17.6	1.00	reference
Immigrated <10 years ago	209	43.2	0.49	0.25, 0.95
Immigrated ≥10 years ago	190	39.3	0.82	0.43, 1.55
Housing type				
Subsidized	253	52.3	0.77	0.49, 1.23
Market rental	231	47.7	1.00	reference

*Odds ratios were derived from multivariate logistic regression, adjusted for all other variables in the table.

[†]Other sources of income include Employment Insurance, Worker's Compensation, Child Tax Benefits, seniors' benefits, child support, and rent paid by tenant(s) living in the dwelling.

[‡]Two-parent families, *n* 206; lone-father households, *n* 18.

[§]Immigrant status is based on the household respondent and/or his/her partner if applicable. In households in which both the respondent and partner were born outside Canada, immigrant status is based on the individual who immigrated most recently.

^{||}The odds ratio for household income pertains to increments of \$CAN 1000.

mother, and those in which the respondent had less than a high school education⁽³⁹⁾. There was also a positive association between severe food insecurity and the number of children in the household. After accounting for socio-demographic covariates, the proportion of variation in both food insecurity and severe food insecurity at the neighbourhood level was zero.

The average distance that a household had to travel to reach a discount grocery store was 1.3 km, ranging from 0.01 to 2.70 km across households and from 0.25 to 2.57 km on average across neighbourhoods. Over four-fifths (82.9%) of families lived within 2 km and 41.1% of families lived within 1 km of a discount supermarket. In nine neighbourhoods, all families lived within 2 km of a discount supermarket whereas in one neighbourhood, no family sampled lived within 2 km of a discount supermarket (Table 2). Over three-quarters of families (78.1%) agreed that there was adequate access to places to buy food in their neighbourhood and a similar proportion (75.2%) did the bulk of their food shopping in their neighbourhood; but across neighbourhoods, these proportions ranged from 25.5% to 95.2% (Table 2). A negative curvilinear relationship was apparent between the distance to the nearest discount supermarket and the probability that a family indicated they had adequate access to food retail in their neighbourhood (Fig. 1). For example, while families living 1.5 km from a discount supermarket had an 80% probability of reporting their

access as adequate, this probability fell to 42% for families living 2.5 km from a supermarket. However, there was no association between whether families perceived their food retail access to be adequate and whether they were food insecure (OR = 0.75, 95% CI 0.46, 1.22; adjusted OR (AOR) = 0.87, 95% CI 0.53, 1.41) or severely food insecure (OR = 0.78, 95% CI 0.45, 1.15; AOR = 0.77, 95% CI 0.47, 1.29).

Of those participants reporting adequate access to food retail, 92.6% lived within 2 km of a discount supermarket. However, there were no associations between whether families lived within 2 km of the nearest discount supermarket and whether they were food insecure in either the unadjusted (OR = 0.93, 95% CI 0.53, 1.64) or adjusted model, although the effects of income, reliance on welfare and immigrant status on household food security status persisted (Table 3). Similarly, no association with household food insecurity was observed with the use of a continuous distance variable or a threshold of 1 km (data not shown). There were also no significant associations between geographic access to discount supermarkets and severe food insecurity (data not shown) aside from the marginally significant higher odds of severe food insecurity among families that did not live within 2 km of a discount supermarket (OR = 1.63, 95% CI 0.97, 2.74). This marginal effect did not persist with the inclusion of sociodemographic covariates in the model (AOR = 1.20, 95% CI 0.69, 2.09).

Table 2 Household food insecurity, food retail access and perceived social capital by neighbourhood* (n 12), Toronto, Ontario, Canada, November 2005–January 2007

Neighbourhood (no. of families sampled)	Prevalence of household food insecurity (%)	Distance to a discount supermarket (km)		Proportion within 2 km of a discount supermarket (%)	Proportion reporting adequate food retail access (%)	Proportion shopping in their local area (%)	Distance to a food bank (km)		Distance to a community kitchen (km)		Distance to a community garden (km)		Proportion with low perceived social capital (%)
		Mean	SD				Mean	SD	Mean	SD	Mean	SD	
Total (484)	65.3	1.26	0.75	82.9	78.1	75.2	2.50	2.21	4.00	3.18	3.84	3.98	44.8
1 (37)	70.3	1.16	0.20	100	75.7	78.4	0.53	0.24	0.82	0.16	0.72	0.10	40.5
2 (42)	69.1	0.25	0.21	100	95.2	95.2	0.58	0.39	0.59	0.47	1.00	0.51	66.7
3 (71)	67.6	0.46	0.26	100	91.6	93.0	0.43	0.16	0.61	0.16	2.58	0.39	47.9
4 (38)	57.9	1.43	0.21	100	92.1	89.5	5.14	0.21	1.77	0.11	0.52	0.13	50.0
5 (33)	45.5	1.94	0.71	54.6	60.6	54.6	2.42	0.20	4.74	0.40	3.29	0.46	27.3
6 (39)	76.9	1.23	0.26	100	89.7	84.6	7.94	1.19	1.38	0.51	2.49	0.22	41.0
7 (41)	56.1	1.56	0.12	100	87.8	87.8	1.56	0.12	10.01	0.12	2.09	0.12	39.0
8 (14)	64.3	1.79	0.14	100	85.7	85.7	1.79	0.14	6.31	0.14	0.79	0.14	42.9
9 (41)	70.7	0.83	0.43	100	85.4	58.5	1.20	0.42	5.55	0.59	10.53	0.35	63.4
10 (41)	56.1	1.81	0.70	48.8	63.4	56.1	2.29	0.23	6.25	0.26	1.60	0.95	19.5
11 (40)	70.0	1.00	0.10	100	82.5	95.0	3.02	0.10	8.39	0.11	13.69	0.11	50.0
12 (47)	72.3	2.57	0.15	0	25.5	25.5	4.17	0.16	5.14	0.05	5.19	0.10	42.6

*Neighbourhoods 1–3 are located in the downtown core, whereas neighbourhoods 4–12 are distributed throughout other parts of the Greater Toronto Area.

Costs for transportation to and from the grocery store were incurred by 61.4% of families, with the amount of money spent per round trip averaging \$CAN 7.46 (SD \$CAN 6.21). About a quarter of families (26.5%) drove their own vehicle to the supermarket; the remainder walked or bicycled and reported no cost for transportation. Among those reporting transportation costs, 28.9% lived within 1 km and 75.8% lived within 2 km of a discount supermarket. Approximately half (57.4%) of those indicating that they had adequate access to food retail in their neighbourhood reported transportation costs to and from the grocery store. There was no relationship between whether families incurred costs for transportation for grocery shopping and whether they were food insecure (OR = 1.32, 95% CI 0.88, 1.97; AOR = 1.38, 95% CI 0.90, 2.11) or severely food insecure (OR = 1.18, 95% CI 0.77, 1.80; AOR = 1.34, 95% CI 0.84, 2.15).

The average distances to the nearest food bank, community kitchen and community garden by neighbourhood are outlined in Table 2. There were no significant associations between whether or not families were food insecure and whether they lived within 2 km of a food bank (OR = 0.88, 95% CI 0.56, 1.39; AOR = 0.82, 95% CI 0.55, 1.22), community kitchen (OR = 0.77, 95% CI 0.50, 1.20; AOR = 0.78, 95% CI 0.52, 1.17) or community garden (OR = 1.14, 95% CI 0.73, 1.76; AOR = 1.09, 95% CI 0.72, 1.65). There were also no significant effects on household food insecurity when we used continuous distance variables or thresholds of 1 km, nor for proximity to these programmes and severe food insecurity (data not shown).

The perceived neighbourhood social capital of 44.8% of families was characterized as low, ranging across neighbourhoods from 19.5% to 66.7% (Table 2). In the unadjusted model, low social capital was associated with higher odds of household food insecurity (OR = 1.51, 95% CI 1.03, 2.22); this effect did not persist once sociodemographic variables were included although the effects of income, reliance on welfare and immigrant status on household food security status remained (Table 4). There was no significant association between social capital and household food security status when we predicted severe food insecurity (OR = 1.27, 95% CI 0.85, 1.90; AOR = 1.10, 95% CI 0.70, 1.73).

Discussion

A very small proportion of the variation in household food security among the families in the current sample was a function of the neighbourhood of residence and this variation was attributable to compositional differences in the sociodemographic characteristics of families. In particular, the significant effects of income, reliance on welfare and immigrant status on food security status persisted through all of our models. The finding of higher odds of food insecurity with declining income is intuitive

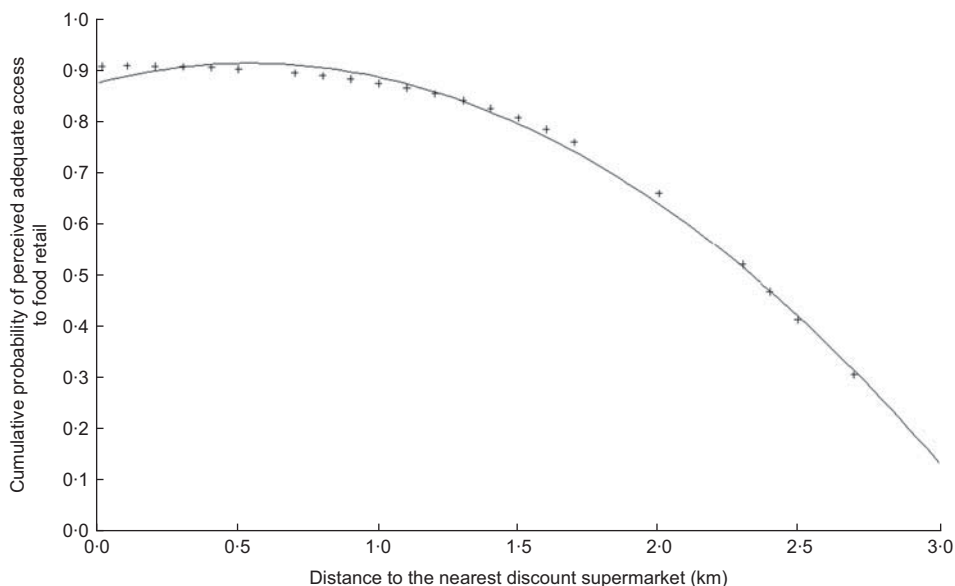


Fig. 1 Cumulative probability plot depicting the relationship between the distance to the nearest discount supermarket (km) and perceived adequacy of food retail access among respondents (*n* 484) from low-income families who had children and who lived in rental accommodations, Toronto, Ontario, Canada, November 2005–January 2007

Table 3 Household food insecurity in relation to proximity to discount supermarkets among respondents (*n* 484) from low-income families who had children and who lived in rental accommodations, Toronto, Ontario, Canada, November 2005–January 2007

	Adjusted OR of food insecurity*	95 % CI
Do not live within 2 km of a discount supermarket	0.73	0.43, 1.26
Income (in \$CAN 1000 units)	0.97	0.95, 1.00
Number of adults	0.97	0.71, 1.34
Number of children	1.20	0.97, 1.49
Main source of income		
Employment	1.00	reference
Welfare	2.52	1.44, 4.43
Other sources†	1.49	0.81, 2.73
Household type		
Two-parent or lone-father	1.00	reference
Lone-mother	1.11	0.66, 1.88
Highest level of education attained by household respondent		
Less than high school graduation	1.03	0.61, 1.74
Completed high school	1.00	reference
Immigrant status‡		
Born in Canada	1.00	reference
Immigrated <10 years ago	0.50	0.26, 0.97
Immigrated ≥10 years ago	0.85	0.45, 1.61
Housing type		
Subsidized	0.81	0.50, 1.29
Market rental	1.00	reference

*Adjusted odds ratios were derived from multivariate logistic regression, adjusted for all other variables in the table.
 †Other sources of income include Employment Insurance, Worker’s Compensation, Child Tax Benefits, seniors’ benefits, child support, and rent paid by tenant(s) living in the dwelling.
 ‡Immigrant status is based on the household respondent and/or his/her partner if applicable. In households in which both the respondent and partner were born outside Canada, immigrant status is based on the individual who immigrated most recently.

given that, by definition, food insecurity is related to inadequate financial resources to obtain adequate food. However, the fact that we were able to observe this relationship even in a low-income sample speaks to the potency of this effect. The vulnerability of families reliant on welfare is also not surprising given evidence of the

inadequacy of current benefit levels in Ontario⁽⁴⁵⁾. The apparent lower vulnerability to food insecurity among recent immigrants compared with those who are Canadian born and immigrants who have been in the country for a longer period of time has also been observed at a national level⁽⁶⁾. This finding has not been explored but

Table 4 Household food insecurity in relation to perceived neighbourhood social capital among respondents (*n* 484) from low-income families who had children and who lived in rental accommodations, Toronto, Ontario, Canada, November 2005–January 2007

	Adjusted OR of food insecurity*	95% CI
Low perceived neighbourhood social capital	1.33	0.88, 2.00
Income (in \$CAN 1000 units)	0.97	0.95, 1.00
Number of adults	1.04	0.75, 1.45
Number of children	1.22	0.98, 1.51
Main source of income		
Employment	1.00	reference
Welfare	2.30	1.30, 4.07
Other source†	1.44	0.78, 2.65
Household type		
Two-parent or lone-father	1.00	reference
Lone-mother	1.18	0.69, 2.00
Highest level of education attained by household respondent		
Less than high school graduation	1.01	0.59, 1.70
Completed high school	1.00	reference
Immigrant status‡		
Born in Canada	1.00	reference
Immigrated <10 years ago	0.46	0.23, 0.93
Immigrated ≥10 years ago	0.79	0.41, 1.51
Housing type		
Subsidized	0.88	0.54, 1.43
Market rental	1.00	reference
Number of years in the current dwelling	0.97	0.93, 1.01

*Adjusted odds ratios were derived from multivariate logistic regression, adjusted for all other variables in the table.

†Other sources of income include Employment Insurance, Worker's Compensation, Child Tax Benefits, seniors' benefits, child support, and rent paid by tenant(s) living in the dwelling.

‡Immigrant status is based on the household respondent and/or his/her partner if applicable. In households in which both the respondent and partner were born outside Canada, immigrant status is based on the individual who immigrated most recently.

perhaps relates to the ability of immigrants to draw upon resources from their countries of origin in the short term to buffer themselves against low earnings.

The current study adds to the limited evidence available in Canada on the adequacy of food access in low-income urban areas and supports recent arguments by Macintyre that the problem of food deserts is context-specific with no consistent pattern in terms of whether those in poorer communities have poorer access to resources⁽⁴⁶⁾. The majority of the families and neighbourhoods in our study appeared to have relatively good food retail access whether measured objectively using GIS or subjectively based on perceptions of adequacy. There was however some variation, with one neighbourhood in particular having poor access. The greater distances that families residing in this neighbourhood must travel to reach amenities must only add to their stress, especially among those struggling with severe food insecurity. Nevertheless, the distances that families had to travel to food retail did not predict household food security status and high rates of food insecurity were observed even in neighbourhoods in which families lived in very close proximity to discount supermarkets. Thus, while good food access is clearly a desirable neighbourhood characteristic, we found no evidence that geographic accessibility mitigates the effects of financial constraints on household food security status. Although we have considered only one type of food retail in characterizing the local area food environment, the bulk of participants reported that they shopped at discount

supermarkets, suggesting that this type of outlet is most relevant to their household food access.

Our interrogation of the relevance of physical food access to food security is limited in that we studied a small number of relatively homogeneous neighbourhoods, perhaps limiting our ability to precisely discern the relationship between distance to food outlets and household food security. However, our findings are consistent with those of recent studies from Australia which suggest that only a small proportion of variation in food purchasing and consumption is at the level of the neighbourhood^(23,25,47). Similarly, other research has shown that features (either objectively measured or perceived) of the food shopping environment did not explain socio-economic inequalities in fruit and vegetable consumption among a sample of Dutch adults⁽²⁴⁾ and that the local density of fruit and vegetable stores did not explain education-related variations in fruit and vegetable intakes among a sample of Australian women⁽²⁵⁾.

It has been argued that transportation costs can impinge upon the cash available for food^(10,48–50) and that local food access within walking distance is particularly important for those living in low-income areas⁽¹⁵⁾. Our results suggest that the demands associated with grocery shopping for poor families are more complex. Despite the apparent adequacy of food retail access in most neighbourhoods, over half of the families in the present study incurred transportation costs, presumably because it was too difficult for them to carry their groceries home on foot. The proximity of retail access likely afforded them some

advantage, given that taxi costs are a function of distance. Perhaps the modest transportation costs incurred account for our inability to discern an association between proximity to discount supermarkets and household food security status. It is also conceivable that our analysis is confounded by differences in the frequency with which families shopped for groceries during the course of a month – something not assessed in our study. Our results add to the literature⁽¹⁵⁾ highlighting the need to consider both distance and means of transportation when assessing the adequacy of food retail access for low-income families. However, there is also a need for more research to elucidate other factors that may shape low-income households' shopping behaviours.

The close proximity of most families to food banks, community kitchens and community gardens must reflect the deliberate efforts of community agencies to locate these resources in low-income neighbourhoods. The lack of relationship between programme access and household food insecurity can perhaps be explained by the low levels of programme utilization in this sample⁽³⁹⁾ and the limited nature of the supports available from these programmes^(27,51,52). These findings provide further evidence of the need for responses to food insecurity that go beyond community-level supports.

Among the families in our sample, low perceived social capital was associated with higher odds of household food insecurity, similar to Walker *et al.*'s findings of an inverse relationship between social capital and household food insecurity among a sample of low-income Ohio women⁽²⁹⁾. However, Walker *et al.*'s analysis did not account for the potential confounding effect of household characteristics whereas in our study, the loss of the effect of social capital on food insecurity once we included sociodemographic covariates suggests that the observed association is attributable to household-level characteristics. We also observed no effect of perceived neighbourhood social capital on the odds of severe food insecurity, in contrast to the findings of Martin *et al.* who found that social capital was inversely associated with the odds of hunger (a measure of severe food insecurity) among a sample of low-income households in Hartford, Connecticut, even after accounting for socio-economic status. Based on their findings, those authors suggested that interventions that foster the development of social capital might also foster food security⁽³⁰⁾. Our findings provide no support for this argument, but the discrepancy highlights the need for more research on this topic. Pearce and Davey Smith have argued that because social capital, like income inequality and health, is impacted by macro-level social and economic policies, strategies that aim to increase the social capital of communities without also considering the social context may be akin to 'blaming the victim' at a community level and thus may be ineffective or even damaging⁽³⁸⁾. A fuller understanding of the relevance of neighbourhood social capital to

household food security is thus needed before interventions to improve social capital as a means of ameliorating income-related food access problems are warranted.

In summary, the findings of the present study raise questions about the notion that food insecurity is a function of the characteristics of the neighbourhoods in which families live, suggesting that working at a neighbourhood level to improve local area food access or social cohesion may not be an effective strategy for the amelioration of problems of food insecurity that are rooted in inadequate financial resources. Our findings do however support calls for policy change to address the factors that constrain food purchasing among low-income families^(27,53).

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