

Fast Food and Deprivation in Nova Scotia

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ABSTRACT

Objective: To examine the relationship between density of fast food restaurants and measures of social and material deprivation at the community level in Nova Scotia, Canada.

Methods: Census information on population and key variables required for the calculation of deprivation indices were obtained for 266 communities in Nova Scotia. The density of fast food restaurants per 1000 individuals for each community was calculated and communities were divided into quintiles of material and psychosocial deprivation. One-way analysis of variance was used to investigate associations between fast food outlet densities and deprivation scores at the community level.

Results: A statistically significant inverse association was found between community-level material deprivation and the mean number of fast food restaurants per 1000 people for Nova Scotia ($p < 0.000$). Significant positive relationships were found between density of fast food restaurants and psychosocial deprivation ($p < 0.000$). Both associations were principally linear with greater fast food outlet density occurring as material deprivation decreased and as psychosocial deprivation increased.

Interpretation: Community-level deprivation in Nova Scotia is associated with fast food outlet density and lends support for environmental explanations for variations in the prevalence of obesity. Such findings are valuable to population health intervention initiatives targeting the modification of environmental determinants of obesity.

Key words: Psychosocial deprivation; material deprivation; obesity; fast food; mapping

La traduction du résumé se trouve à la fin de l'article.

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In Canada the prevalence of objectively measured obesity, defined as a Body Mass Index (BMI) of ≥ 30.0 , has increased by more than 10% since 1979 with the largest increase among youth (12-17 years of age).^{1,2} As of 2004, 23.1% of all Canadians were classified as obese and 36.1% as overweight ($25 \leq \text{BMI} < 30$).³ Children in Atlantic Canada are more likely to be overweight than children in other regions of Canada.⁴ The rapidity of increasing obesity prevalence has been attributed to environmental more so than genetic influences^{5,6} and has led to the development of research into obesogenic environments.

Multilevel cross-sectional and ecological studies have been employed to explore the environmental factors related to increasing overweight and obesity prevalence. A number of studies have shown a positive association between community deprivation and prevalence of overweight and obesity, even after adjusting for a range of socio-economic and demographic factors.⁷⁻⁹ Environmental mediators of overweight and obesity may be more common in more deprived communities.¹⁰ Deprivation refers to a measure of relative social and/or material disadvantage.¹¹ Theoretically, individuals in more deprived communities may have worse health due to fewer collective resources, particularly if adjacent geographically to similarly deprived communities.¹² In Canada, higher levels of material and social deprivation were associated with decreased life expectancy, increased mortality from tobacco use, as well as increased rates of hospitalization for mental illness.¹³ Environmental mediators of overweight and obesity in Nova Scotia may be more prevalent in more deprived communities; consequently it has been hypothesized that deprived communities may have an excess of unhealthy food retailers, specifically fast food restaurants.¹⁴

Canadians spend almost \$400 annually per capita on fast food, and increasing demands have led to growth in the supply of fast food restaurants with annual sales of approximately \$35.1 billion.^{15,16} The

increasing availability of low-cost, high-energy, high-fat foods, and growth in serving sizes during consumption of food outside the home, suggest that fast food may play a significant role in overall dietary energy intake and quality.^{17,18} Fast food is high in calories, saturated fat and cholesterol, and fast food intake has been correlated with lower dietary quality and higher body mass index.¹⁹⁻²²

While it is frequently suggested that more deprived communities have less access to healthy food, there is a paucity of research on whether community deprivation is associated with the prevalence of fast food restaurants and thus opportunities to consume unhealthy foods. Socio-economic status as an indicator of deprivation has been shown to be inversely associated with the number of fast food restaurants among communities studied in Australia and the United States.^{23,24} Recent studies using deprivation measures have shown mixed results. A study using small census areas in England and Scotland found a higher density of McDonald's restaurants per thousand population in more deprived areas.²⁵ A subsequent study of neighbourhoods in Glasgow found no evidence that restaurants, including fast food chains, were more likely to be found in particularly deprived areas.²⁶

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Nova Scotia has a high prevalence of overweight and obesity which has often been attributed to poor lifestyle choices and dietary behaviours.^{27,28} The objective of this study was to investigate the association between the density of fast food restaurants and indices of material and social deprivation among communities in Nova Scotia, Canada.

METHODS

We obtained the address with full postal code of every McDonald's®, Wendy's®, Kentucky Fried Chicken®, Burger King®, Harvey's®, Dairy Queen®, and Tim Horton's® restaurant in Nova Scotia (n=306) as of July 2006 using Canada411™. Each restaurant address was cross-referenced and any missing address information was supplemented using online store locators found on the website of each restaurant.

The Nova Scotia Community Counts database links public administrative data – such as Canadian Census, Taxfiler, and several provincial databases (Transportation and Public Works data, for example) – at a provincially-relevant level of geography for the purpose of public policy development and decision making. Nova Scotia Community Counts (2006) provided information on age, gender, and several census variables required for the construction of deprivation indices recalibrated to community geography.

Derivation of deprivation indices

We calculated standardized scores for material and psychosocial deprivation for each community using procedures outlined in Pampalon & Raymond and Salmond & Crampton as guides.^{13,29} The following data from the Canadian Census (2001) were abstracted for each community: average individual income (15+ years old), unemployment rate (25+ years old), less than high school diploma (25+ years old), proportion of single parents (15+ years old), divorced, separated or widowed (15+ years old), and proportion of people living alone (15+ years old). Each item was first age-sex standardized using the following formula:

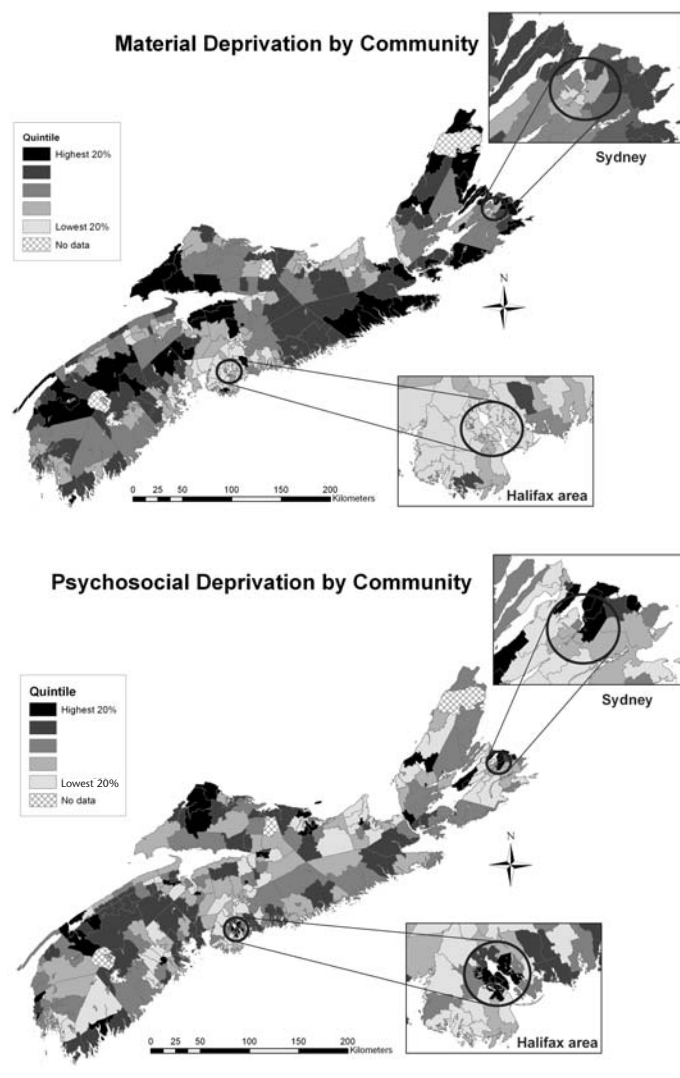
$$\text{Standardized Ratio} = \frac{\sum_i n_i}{\sum_i p_i R_i}$$

where *i* indicates age (in one of six groups: 15-24, 25-34, 35-44, 45-54, 55-64, 65+) by sex (2) = 12 groups. For example, *n* is the number of single parents in the community, *p* is the “at risk population” or population size of the age group in the community, and *R* is the proportion of single parents in each age group in the province. Z-scores were calculated to standardize values in the six items with different units for principal components analysis (PCA) – a variable reduction method. Two components met our criteria of eigenvalue ≥ 1 .³⁰ They explained close to 70% of the total variance among the six variables. VARIMAX rotation was applied to identify which of the six variables were explained by these two factors. The result showed that material deprivation was best explained by average individual income, unemployment rate and less than high school variables. Psychosocial deprivation scores were based on the proportion of single parents, proportion of people living alone, those divorced, separated or widowed. Material and psychosocial deprivation scores were derived from the addition of the standardized variables scores multiplied by their respective weights. For a more detailed description of deprivation score calculations, please refer to Terashima.³¹

Community geography and restaurant geocoding

The geographic unit of analysis for this study is the “community” as identified by Nova Scotia Community Counts using the follow-

Figure 1. Maps of community-level material and psychosocial deprivation in Nova Scotia, 2006



ing general guidelines: a population greater than 1000 persons, 100% coverage of the provincial population, and natural population clusters (rather than reliance on existing legal boundaries). There are currently 278 communities in Nova Scotia, including 20 reserves, 2 national parks, and Sable Island. We excluded data from 12 communities (9 reserves, parks and Sable Island) to preserve confidentiality due to small population sizes.

The fast food restaurant location database was imported into a geographic information system (ArcGIS 9.1, ESRI Corp, Redlands, CA) for geocoding. Geocoding is a process of assigning geographic identifiers (latitude and longitude) that closely approximate true locations.³² Nova Scotia CanMAP Street™ files (DMTI Spatial, Ottawa, ON) contain accurate location information for civic addresses and were used to match fast food restaurants using a semi-automated geocoding function in the GIS software. The function automatically adds accurate coordinate information to the fast food outlet database. Unmatched restaurants were manually assigned coordinates using Google Earth™. In some instances, restaurants were contacted by telephone to verify location. In two cases, we used a handheld global positioning system to assign location information.

Table 1. Mean Number of Fast Food Restaurants per 1,000 People by Deprivation Quintiles

Quintile	Material Deprivation		Psychosocial Deprivation	
	Mean	n	Mean	n
1 (Most Deprived)	0.0473	53	0.4081	53
2	0.0855	53	0.1470	54
3	0.0823	65	0.0556	63
4	0.1283	53	0.0575	53
5 (Least Deprived)	0.3573	52	0.0379	53
Total	0.1401	276	0.1412	276
p value (ANOVA)	0.0000		0.0000	

* Quintiles contain 266 communities. ANOVA = analysis of variance.

Analyses

Geocoded fast food restaurant locations were linked to community-level geography using a spatial join function in the GIS, and a count of the total number of restaurants per community was calculated. Population data for each community from the Community Counts database were then used to calculate fast food outlet density measures. Quintiles of material and psychosocial deprivation (1 = most deprived, 5 = least deprived) were also created for each community. Communities with no fast food restaurants were included in the analysis; communities without deprivation scores were excluded. Data were analyzed using one-way analysis of variance (ANOVA) using MINTAB version 14.³³ Fast food outlet and deprivation data were mapped to spatially assess the distribution to complement the statistical analysis.

RESULTS

We identified 306 fast food restaurants, 276 of which were included in the study for an average of 0.99 restaurants per community, or 0.15 restaurants per 1000 individuals per community. Figure 1 illustrates the geographic distribution of material and psychosocial deprivation in Nova Scotia at the community level. Material deprivation is more prevalent in more rural communities of the province; however, it is important when visualizing this information to note that the preponderance of material deprivation is somewhat artifactual due to the fact that rural communities tend to have much larger boundaries to maintain equal population coverage. Psychosocial deprivation is more prominent in urban communities and there are only a few communities that are deprived both materially and psychosocially, most of which are Aboriginal reserves.

Table 1 shows the mean number of fast food restaurants per 1000 people by deprivation (material and psychosocial) quintile for Nova Scotia. There is a statistically significant ($p < 0.000$) inverse linear association between quintiles of material deprivation and mean number of fast food restaurants per 1000 individuals. A statistically significant ($p < 0.000$) positive relationship between quintiles of psychosocial deprivation and mean number of fast food restaurants per 1000 individuals was found. The prevalence of fast food restaurants is greater in communities with less material deprivation and more psychosocial deprivation.

DISCUSSION

The purpose of this study was to describe the prevalence of fast food restaurants among communities with different levels of material and psychosocial deprivation. Fast food is generally lower in nutritional value and high in calories and saturated fats. Increased density of fast food restaurants may facilitate increased consumption of unhealthy foods and has been identified as a potential environmental mediator

of overweight and obesity. Geographically, the density of fast food restaurants is generally higher in more urban communities, those with less material deprivation and more psychosocial deprivation.

In Nova Scotia, there is a geographical gradient of material and psychosocial deprivation among urban and rural communities; material deprivation is greater and psychosocial deprivation is lower in rural communities whereas the pattern is reversed in urban communities. This is not to say that material deprivation does not exist in urban communities; rather, the analysis relies on aggregate data thus concealing the reality of urban poverty. In contrast, psychosocial deprivation is largely an urban reality. Similar geographical patterns of deprivation have been found elsewhere in Canada.¹³

Some of our results contrast those of earlier studies that demonstrated higher concentrations of fast food restaurants in low-income or more materially-deprived communities.²³⁻²⁵ To the contrary, we found more than double the number of fast food outlets in the most affluent communities when compared to the second-most affluent communities. In this regard, our results are consistent with at least one other study which demonstrated a predominance of fast food restaurants in less materially-deprived communities.²⁶ The prevalence of more fast food restaurants in urban centres may be due to demographic and marketing strategies that take advantage of higher demand, especially those arising from the density of schools and universities as well as youth activities and events.

Our results highlight the possibilities of distinguishing community-level environmental mediators of overweight and obesity for population health intervention. Community-level deprivation profiles allow for targeted health promotion and prevention strategies to communities with the greatest levels of deprivation. Geocoding and geographic display of fast food establishments, while useful for the determination of community density measures, would also be quite valuable in healthy urban planning initiatives and in developing geographic restrictions on access to fast food restaurants near schools, other publicly-funded institutions such as hospitals and universities, or vulnerable populations.

This study has several important limitations. First, only fast food restaurants from well-known national chains were identified and included for analysis. Many local establishments have expedited food service but are not connected to fast food chains. Many single-site, mobile and local "chain" fast food establishments identified as serving pizza, fried chicken, donairs and similar high calorie foods found in larger fast food chains were not included and could have the effect of minimizing the significance of the associations between fast food restaurants and deprivation. It is possible that more rural communities would have a preponderance of independently-owned fast food restaurants as opposed to national or international chains. Moreover, there is also a possibility that rural communities lack the population density required by the location algorithms used by national fast food enterprises to site economically viable operations. Nevertheless, it is unlikely that the number of restaurants were undercounted disproportionately based on demographic and social characteristics of communities.

Second, it is important to note our adoption of an ecological cross-sectional study design in the analysis. While the design is not inherently a limitation for the interpretation of our analysis, it is restricted to a discussion of the relationships between fast food restaurant density and deprivation at the community level and not among individuals. Consequently, we do not presume causality

from the prevalence of fast food restaurants and measures of deprivation, even after standardizing for age and gender – two important determinants of population health.

Third, census-based deprivation indices, like the one used in our study, are subject to the weakness of potentially concealing important variations within areas. Methodological improvements to minimize loss of information due to coarse aggregation used in census – such as by combining local knowledge of medical health officers through a survey – have been suggested.³⁴

Fourth, despite our finding of an association between fast food restaurant density and deprivation, the directionality of the relationship is equivocal. For example, community characteristics could be shaped by the type of food outlets and other services available which make the community more or less desirable. Likewise marketers and restaurant owners may establish restaurants in communities with specific demographic and socio-economic profiles with the aims of reaching target consumers and maximizing profits.

Finally, our study is focused on one province and limits the generalizability of the results. The association between fast food restaurant density and deprivation measures may exist as a result of the unique characteristics of the region.

The rapid increase in the prevalence of overweight and obesity points to the role of obesogenic environments and specifically the health risks arising from increased access to unhealthy fast foods. Material affluence and psychosocial deprivation are associated with a greater prevalence of fast food restaurants across communities in Nova Scotia. Future research should incorporate additional environmental variables, such as exposure to television, access to amenities for physical activity, and other health-promoting attributes of the built environment. Our findings reinforce the potential for population health intervention strategies to modify the environmental determinants of overweight and obesity at the community level.

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RÉSUMÉ

Objectif : Examiner la relation entre la densité des restaurants rapides et les mesures de la défavorisation sociale et matérielle à l'échelle des agglomérations en Nouvelle-Écosse (Canada).

Méthode : Nous avons extrait les données du Recensement et obtenu les grandes variables nécessaires au calcul des indices de défavorisation pour 266 agglomérations néo-écossaises. Nous avons calculé la densité des restaurants rapides pour 1 000 habitants dans chaque agglomération et divisé les agglomérations en quintiles de défavorisation matérielle et psychosociale. Une analyse unidirectionnelle de la variance a servi à examiner les associations entre la densité des restaurants rapides et les scores de défavorisation à l'échelle des agglomérations.

Résultats : Nous observons une association inverse significative entre la défavorisation matérielle dans les agglomérations et le nombre moyen de restaurants rapides pour 1 000 habitants en Nouvelle-Écosse ($p < 0,000$). Nous observons aussi une relation positive significative entre la densité des restaurants rapides et la défavorisation psychosociale ($p < 0,000$). Ces associations sont principalement linéaires : plus la défavorisation matérielle diminue et plus la défavorisation psychosociale augmente, plus la densité des restaurants rapides est forte.

Interprétation : La défavorisation à l'échelle des agglomérations de la Nouvelle-Écosse est associée à la densité des restaurants rapides, ce qui tend à confirmer les explications environnementales des écarts dans la prévalence de l'obésité. Nos constatations présentent un intérêt pour les mesures d'intervention en santé des populations qui visent à modifier les déterminants environnementaux de l'obésité.

Mots clés : défavorisation psychosociale; défavorisation matérielle; obésité; repas rapides; mappage