

Determinants of variation in food cost and availability in two socioeconomically contrasting neighbourhoods of Hamilton, Ontario, Canada

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Abstract

This study addresses links between economic and nutritional variation in an urban North American setting. We employed a mixed-methods approach including mapping, semi-structured interviews, and food outlet surveys to investigate the public health impact of variation in the cost and availability of food between two socioeconomically distinct neighbourhoods of the City of Hamilton, Ontario, Canada. Food cost in supermarkets was not found to be higher in the low-income neighbourhood, though it was much higher in the variety stores that predominate in the low-income neighbourhood. Moreover, there was a very low availability of produce in the variety stores. Reduced fresh produce availability and lower incomes have the potential to negatively influence public health in the less-affluent study area by increasing the difficulty of acquiring healthy foods.

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Introduction

The effect of diet on human health has long been recognized. In market-based economies, variation in food cost and availability can combine with socio-economic disparities to cause and/or reinforce health inequalities. Whether the poor pay more for food has been debated since Caplovitz's (1963) finding that the poor pay more for durable goods. However, this question needs to be broadened to include local-level factors and the spatialization of poverty as significant determinants of food cost and

availability. Indeed, researchers from many disciplines have investigated linkages between area affluence, retail provision, and neighbourhood variation in food cost and access in Canada, the UK, and the US (Alcaly and Klevorick, 1971; Ambrose, 1979; Chung and Myers, 1999; Cummins and Macintyre, 1999, 2002b; Curtis and McClellan, 1995; Donkin et al., 2000; Eisenhauer, 2001; Moon-ey, 1990; Morland et al., 2001; Sooman et al., 1993; Travers et al., 1997). Prohibitive food cost and lack of access are important determinants of food insecurity, which may be defined as the "inability to acquire an adequate diet quality or sufficient quantity of food in socially acceptable ways, or the uncertainty that one will be able to do so" (McIntyre, 2003, pp. 46–47). This study investigates

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whether differences in food cost and availability exist between two socioeconomically contrasting areas of the City of Hamilton, Ontario, Canada, and how these differences, if they exist, might play a role in shaping differences in health between more- and less-affluent residents of the city.

We employ a biocultural approach that investigates the interaction of social-cultural, political-economic, and physical environments, and how these shape human behaviour and biology (Goodman and Leatherman, 1998). We also employ a health and area approach, which has been fruitfully applied to studies of urban environments, many of which have found that the neighbourhood or area in which one lives has health effects independent of individual or population-level characteristics (see Kawachi, 2002; Macintyre et al., 2002 for a review of these studies).

The ecological variables influencing human health have various names depending on one's preferred theoretical orientation. Many would agree, however, with Goodman and Leatherman (1998, p. 11) that attention to the social context in which humans live "aids us in understanding biologies: who becomes ill and what are the consequences, who gets food when food is limited, and why is food limited in the first place". Studying human biology in its social, geographical, and physical contexts allows us to realize that differences in health are neither natural nor part of a 'natural social order'.

This study investigates food availability in the City of Hamilton to discern whether it is more difficult for less-affluent residents of the 'inner city' to consistently acquire a healthy diet. Because of the system's complexity, a mixed-methods approach is adopted in an attempt to arrive at a set of "comprehensive and valid" answers (Baum, 1995, p. 463). Research questions are:

1. Do food prices vary between two socioeconomically contrasting areas of the city?
2. Does the cost and availability of food items and the availability of fresh produce vary with store type or area affluence?
3. Are healthy foods less accessible in one of the two areas?

We argue that the answers to the types of questions posed by this research project can play a role in developing policy solutions that may lead to better health for low-income residents in the City of Hamilton and elsewhere.

Background: diet, health, and food cost

Poor diet contributes to the risk of gallstones, dental caries, osteoporosis, and certain cancers (Robertson et al., 1999). There are links between dietary trans fats and coronary heart disease, hypercholesterolemia, obesity, and insulin resistance (Mann, 1994). Diet is also connected to health through its influence on body weight: Overnutrition relative to activity level can lead to overweight and obesity, conditions which increase risk for cardiovascular disease, type 2 diabetes, stroke, and some cancers (Katzmarzyk, 2002). Undernutrition increases the risk of developing anaemia, infections, and other health problems in children (McIntyre et al., 1998) and increases mortality risk in adults (Katzmarzyk et al., 2001). Further, inadequate childhood nutrition is associated with decreased mental capacities and increased morbidity throughout life (Beaton, 1989; Davey-Smith and Brunner, 1997; Gleason and Sutor, 2001; Tufts University Center on Nutrition, Poverty, and Policy, 2002). In addition, many disorders are linked to deficiencies of certain micronutrients (Scrimshaw, 2000; Edmonds, 2000; Kendall and Kennedy, 1998 and references therein).

Diet can also promote health. Diets low in saturated fat and sugar, and high in fibre may prevent some cancers and coronary heart disease (Rimm et al., 1996; Robertson et al., 1999). Steinmetz and Potter (1996) reviewed over 200 epidemiological studies, both cross sectional and cohort, looking at the relationship between vegetable and fruit consumption and cancer, finding that the consumption of these foods was protective for cancers of the stomach, esophagus, lung, mouth, pharynx, endometrium, and colon. Zheng et al. (1992) found that a diet high in vegetables, garlic, and fruit was protective against laryngeal cancer. Italian studies found consuming a wide variety of vegetables reduced the risk of colon and rectal cancer; carrots and raw vegetables have been associated with lowered risk for colon, rectal, and breast cancer (Fernandez et al., 2000; Franceschi et al., 1998). Similar findings have been reported in Spain, France, Israel, and Greece (Franceschi et al., 1998). Williams et al. (1999) reported that the consumption of vegetables throughout the year reduced diabetes risk. It has been suggested that micronutrients and antioxidants, which are abundant in fruits and vegetables, might be responsible for these health effects (Steinmetz and Potter, 1996;

James et al., 1997; Facchini et al., 2000); several experimental studies support this (see Facchini et al., 2000; Williams et al., 1999).

As diet affects health, socioeconomic status (SES) affects what foods are reported purchased and consumed. Power (2004) reviews research from Europe, the US, and Canada, finding higher SES correlates with the consumption of diets closer to dietary recommendations. A Canadian study shows that high-income households consume more fresh produce than lower-income households (Kirkpatrick and Tarasuk, 2003). National survey data from the UK (National Statistics, 2005) show that members of the lowest income quintile purchase the highest quantities of non-carbass meat and meat products and sugar and preserves and consume the lowest amounts of vegetables (excluding potatoes) and fruit. These households also have the lowest intakes of vitamin C, magnesium, and several B-vitamins (National Statistics, 2005). In the US, Kendall et al. (1996) found that food-insecure individuals consumed fewer fruits, vegetables, vitamin C, and fibre. Turrell et al. (2002) found that in Brisbane, Australia, less-affluent individuals were less likely than their more-affluent counterparts to purchase foods that were low in fat, salt, and sugar and high in fibre; the less affluent also purchased fruit less often than the more affluent.

Many reasons have been proposed to explain the socioeconomic variation in diet. Some have suggested that food prices vary inversely with area affluence. Two types of studies are reviewed here: large studies comparing the costs of relatively few foods over many cities or a nation and smaller studies comparing the cost and availability of a larger number of foods within a city or cities. Regardless of the type of study, results from the US, Canada, and the UK generally find that food cost does not vary with area affluence.

Large studies

Horton and Campbell (1990) analysed 1984 Canadian Family Food Expenditure Survey data for 37 basic foods, finding that while low-income households spend a higher percentage of their food budgets in small variety or convenience stores, where food costs more, this group purchased cheaper brands than did higher-income households with the net effect of little or no difference in food cost per item. In the US, Groom (1966) used Bureau of Labor Statistics data on 18 food items gathered

from food outlets in six cities and found no relationship between market prices and neighbourhood income. McDonald and Nelson (1991) used USDA supermarket food price survey data to compare the cost of a food basket representing the consumption patterns of food stamp recipients. Their sample included prices from 322 supermarkets in 10 large cities. They found that retail food prices were 2% more expensive, on average, in poor zip (= postal) codes. However, when only central city zip codes were compared, the difference between poor and non-poor zip codes is very small (0.38%) and not statistically significant. Using Bureau of Labor Statistics, Hayes (2000) analysed the prices of five food items in a sample of 2181 stores in 43 states, finding that market prices are up to 6% lower in poor zip codes than in non-poor zip codes. Frankel and Gould (2001) broadened the range of income groups from the poor/non-poor dichotomy to include poor (below the poverty line), lower-middle income (between one and two times the poverty line) and middle-higher income (greater than two times the poverty line) in comparing the cost of five foods across 184 cities. In this study, lower food cost was not related to poverty rate but the presence of lower-middle income residents—the intermediate group of the three groups included in the analysis. Frankel and Gould (2001, p. 237) found that “prices increase when the lower-middle income households in a community are replaced by either poor [low-income] or middle-higher income residents”. The findings of Finke et al. (1997) run counter to this trend. They presented data on the expenditure of nine foods that were linked with sociodemographic data on over 10,000 individuals. In this study, high-income urban consumers paid more for food than did low-income urban consumers.

Small studies

Travers et al. (1997) gathered price data for several food baskets containing between 64 and 68 foods at 19 supermarkets in urban Halifax, Nova Scotia. No significant differences in food cost were found between stores in low-income neighbourhoods and stores in mixed-income neighbourhoods. Rankin (2001) found that the price of a basket of 49 foods in 30 stores in Edmonton, Alberta, was higher in less-affluent areas, though the difference was not significant. Mooney (1990) investigated the cost and availability of 15 healthy and 15 unhealthy foods in

nine London supermarkets, finding that food was slightly cheaper in deprived areas than in affluent areas, though healthier food choices were relatively more expensive in the more deprived area; this study did not include statistical tests. Repeating Mooney's (1990) protocol exactly, with the exception of a supermarket that had closed, Hollington and Newby (1995) found that the less healthy basket was approximately 5% cheaper in the more deprived area, while the healthy basket was 1.5% more expensive in the more deprived area. Sooman et al. (1993) reported results from a study including 20 food shops in Glasgow, Scotland, and found that food was slightly more expensive in the poorer of two study areas. This study was later described by one of the authors (Cummins and Macintyre, 2002a, p. 437) as "exploratory" and hence did not include statistical tests. Also working in Glasgow, Cummins and Macintyre (2002b) assessed the price and availability of 57 foods at 250 Glasgow food retailers, finding that only five food items differed significantly in price between more and less-affluent postal codes; of those items, four were cheaper in less-affluent areas.

There are many US studies. Marcus (1969) compared the cost of 86 foods at 49 stores in two southern California cities of differing affluence, finding that total cost was not significantly different between the two cities. Alcala and Klevorick (1971) reported similar results for price data on 31 foods from 46 neighbourhoods in New York City. Kunreuther (1973) studied the issue in New Haven, Connecticut, using price data for eight foods from 22 stores. He reports that food was more expensive in poorer neighbourhoods, though this study compared large chain stores to small neighbourhood stores. Working in Omaha, Nebraska, Ambrose (1979) compared 54 foods in 14 stores, finding that prices in poor inner-city areas were not significantly different from prices in more-affluent areas and were in some cases lower. Chung and Myers (1999) surveyed the price of 50 food items in 55 stores in Minneapolis–St. Paul, Minnesota, finding no significant difference between poor and non-poor zip codes when comparing simple price totals or when the cost of a market basket was computed.

In sum, there appears to be little to suggest that food prices are higher in less-affluent areas. Two of the US studies finding higher costs in less-affluent areas (Hayes, 2000; Finke et al., 1997) included findings suggesting that racist attitudes in the US

play a stronger role than poverty per se in determining food prices in poor neighbourhoods. Additionally, some of the variation in results may stem from differences between studies in definitions of study areas, SES, and outcome variables.

Other research has suggested that the distribution of food outlets throughout a city varies with area affluence. Little research of this type exists for Canada (Power, 2004). In Glasgow, Scotland, Cummins and Macintyre (1999) found that food outlets in general and large stores in particular were *more* common in more deprived postal codes and localities in the greater Glasgow area. In the US, Chung and Myers (1999) found that chain stores, which had larger selections, were less likely to locate in poor zip codes in Minneapolis–St. Paul, Minnesota. Surveying 21 metropolitan areas using 1990 census data, Cotterill and Franklin (1995) found that low-income areas tend to be underserved by supermarkets. Morland et al. (2001), in a study of food outlets in Mississippi, North Carolina, Maryland, and Minnesota, found that there are more than three times as many supermarkets in high-medium and high-wealth areas than there are in the lowest-wealth areas. Curtis and McClellan (1995) report on similar circumstances in Wilmington, Delaware. By contrast, Winkler et al. (2005) assessed opportunities to purchase fresh fruits and vegetables in Brisbane, Australia, finding minimal or no socioeconomic differences.

There is some evidence that better access to supermarkets can improve diets. Sallis et al. (1986) found that supermarkets stocked on average significantly more "heart healthy" foods as did smaller grocery stores and small variety or convenience stores in San Diego, California. Morland et al. (2002) found that residents of neighbourhoods with one or more supermarkets were more likely to be eating diets that met dietary recommendations and reported higher fruit-and-vegetable intakes. Wrigley et al. (2002), using food consumption surveys performed before and after the construction of a large supermarket, found that fruit-and-vegetable consumption increased as consumers shifted away from shopping at small, neighbourhood stores toward the supermarket. However, the increased produce consumption in the low-income group was still below levels found in more-affluent households. Cummins et al. (2005) performed a similar study, with the important difference of including a control sample. They did not find evidence that the construction of a supermarket influenced fruit-

and-vegetable consumption. Moreover, in a mailed-survey study, Dibsall et al. (2003) found that among low-income consumers in East Anglia, consumer motivation to purchase and consume fresh produce might be as important, if not more important, than access and affordability.

The existence of a “wealth and health” gradient appears certain (Feinstein, 1993; Smith, 1999; Adler and Ostrove, 1999; Marmot, 1999; Deaton, 2002; Coburn, 2004) and remains after many risk factors that are more common among the less affluent are accounted for (Davey-Smith and Brunner, 1997; Marmot, 1999). It is possible that variation in diet contributes to the socioeconomic gradient in health. Indeed, food insecurity is more common among the less-affluent and is associated with many measures of ill health (Che and Chen, 2001 and references therein, Carlson et al., 1999, as cited in Himmelgreen et al., 2000; Kendall and Kennedy, 1998 and references therein, McIntyre, 2003; Kendall et al., 1996; Tarasuk and Beaton, 1999).

Methods

Description of study areas

The study areas for this project were chosen to complement a larger study conducted at McMaster University. The Child Nutrition and Food Insecurity in an Urban Canadian Context research project (Moffat et al., 2005) investigates whether and how SES affects the nutritional well-being of children attending Hamilton primary schools. The more-

affluent area in this study, Uptown, corresponds to the neighbourhood boundaries of one of the schools in the Child Nutrition study. The less-affluent area, Downtown, encompasses the areas from which the less-affluent schools included in the Child Nutrition study draw their students. The Downtown area is located in the inner City of Hamilton, in close proximity to the steel mills that, along with McMaster University, underpin much of Hamilton's economy. This area includes the most deprived areas of the city. In contrast, Uptown, one of the most affluent areas of the city, is located at the west end of Hamilton, close to the university. Uptown residents enjoy much greater access to green space and a less congested urban atmosphere, but Uptown is still located within the urban boundaries of the city, as opposed to the suburban areas. Thus, the two neighbourhoods in this study represent the extremes of the high and low SES areas of the city.

Table 1 presents socioeconomic and demographic indicators for Uptown (census tracts 045 and 046), Downtown (census tracts 034, 035, 036, 049, 050, 062, and 063), and the City of Hamilton (all census tracts). Census tracts are areas that are small and relatively stable; they usually have a population of 2500–8000 and are located in large urban centres that must have an urban core population of 50,000 or more (Statistics Canada, 2003). All data are from the 2001 national census (Statistics Canada, 2001). Because census tracts may vary in their demographic characteristics, we present for each census tract the range and mean values for each variable. The Downtown is more densely populated; has a

Table 1

Selected socioeconomic and demographic indicators for Uptown (census tracts 045 and 046), Downtown (census tracts 034, 035, 036, 049, 050, 062, and 063), and Hamilton (Statistics Canada, 2001)

	Uptown	Downtown	Hamilton
Population	6951	25,342	490,268
Square kilometre	4.4	3.9	1,117.1
Population density per sq km	1194–2551 (1580) ^a	5277–9404 (6548)	438.9
% Lone parent family	14–20 (16)	22–35 (26)	16.6
% Immigrants	23–33 (27)	24–51 (37)	26
% Unemployed	5.2–6.1 (5.7)	6.1–23.1 (11.5)	6.4
Average family income (\$1000s)	65–110	32–42	66
Median family income (\$1000s)	60–95	23–38	58
% Below LICO ^b	3.1–14.7 (8.5)	38–57 (43.2)	16.1
Education: % less than grade 9	1.7–4.3 (2.9)	7–25 (17)	10
Education: % trade certificate or diploma	3.1–6.8 (4.8)	5–10 (7)	11
Education: % any university	48–69 (58)	7–24 (16)	20

^aValues in parentheses are means. Other values show the range for the census tracts in the study areas.

^bLow-income cut off (LICO) for a family of four in a city the size of Hamilton was \$29,653 in 2001.

higher percentage of immigrants, lone parents, and unemployed residents; residents are less affluent and educated than those living in Uptown and the City of Hamilton.

Research methods

Both qualitative and quantitative methods were employed. The methods included food outlet mapping, food-price surveys, produce availability surveys, and semi-structured interviews with food outlet owner/managers and public health professionals. Ethics clearance was obtained from the McMaster University Research Ethics Board. Address information for food outlets was collected via a pedestrian survey. Food outlets were classified using a scheme based on Nevraumont's (1987) categories (Fig. 1).

Variation in food cost was assessed using the 1998 Ontario Nutritious Food Basket (ONFB) (Health Canada, 1998) (Fig. 2). Only supermarkets, grocery stores, and variety stores were included in the survey, as only these stores could be expected to stock a reasonable percentage of ONFB items.

The number of food outlets located in the two study areas was quite different (Table 2). After excluding specialty stores, six outlets were located in the Uptown study area; 49 were located in the Downtown study area. The small number of outlets in Uptown represents a small sampling universe, limiting the ability to compare the two areas using statistical tests.

For the food basket survey, four of six Uptown outlets and 13 of 49 Downtown outlets were surveyed. Attempts were made to sample all Uptown food outlets. Citing concerns about price competition, two outlets—both variety stores—refused permission to record prices. Given the resources available, it was not possible to sample all Downtown food outlets. Because of the relatively small number of supermarkets and grocery stores, attempts were made to sample all of these outlets.

Supermarkets: Large retail stores offering a wide variety of grocery items and often other services, such as deli and butcher counters and photo finishing.

Grocery stores: Retail stores smaller than supermarkets that offer a variety of grocery items, without the specialty counters and other services.

Variety stores: Retail stores offering a smaller variety of grocery items and devoting relatively large amounts of space to items such as non-prescription drugs, tobacco products, and other products.

Specialty stores: Retail stores specializing in fewer food types, such as bakeries, butcher stores, or stores specializing in religious/ethnic foods.

Both supermarkets provided access, as did three of the six grocery stores. The three included grocery stores were relatively distant from one another within the study area. For the variety stores, a list of 15 randomly selected variety stores out of a total of 41 variety stores was generated in order to make the task of approaching managers and conducting the food-cost survey more manageable. Of the 15

<u>Milk Products</u> milk (2% fat)* yogurt (fruit, 2% fat) cheddar cheese processed cheese slices mozzarella cheese vanilla ice cream	<u>Citrus Fruits and Tomatoes</u> oranges apple juice, canned orange juice, frozen, concentrate tomatoes whole tomatoes, canned tomato juice
<u>Eggs</u> grade A large	<u>Other Fruit</u> apples bananas grapes pears raisins, seedless fruit cocktail, canned in juice
<u>Meat, Poultry, Fish</u> round steak boneless stewing beef ground beef, medium pork chops, loin chicken legs wieners, beef & pork sliced ham, 11% fat frozen fish fillets pink salmon, canned tuna, canned, in water	<u>Vegetables</u> potatoes, fresh french fries, frozen broccoli cabbage carrots celery cucumber lettuce, iceberg lettuce, Romaine onions green peppers turnips (rutabaga) mixed vegetables, frozen kernel corn, canned green peas, canned
<u>Meat Alternatives</u> baked beans, tomato sauce, canned white beans, dry peanut butter	<u>Fats and Oils</u> margarine, tub butter Canola oil Dressing, mayonnaise (< 35% oil)
<u>Grain Products</u> bread, enriched, white bread, whole wheat hot dog/hamburger rolls flour, all purpose flour, whole wheat spaghetti/macaroni rice, long-grained, white, parboiled macaroni/cheese dinner oatmeal, regular/quick-cooking corn flakes Shreddies™ soda crackers social teas	<u>Sugar and Sweets</u> sugar, white strawberry jam

*Items used to compare prices between variety stores are in bold.

Fig. 2. The Ontario Nutritious Food Basket (Health Canada, 1998).

Fig. 1. Food outlet classification scheme.

Table 2
Distribution of food outlets by study area

	Variety	Grocery	Supermarket	Specialty	Total
<i>Uptown</i>					
Number (%)	4 (44)	1 (11)	1 (11)	3 (33)	9
Number/1000 pop.	0.58	0.14	0.14	0.43	
Number/km ²	0.91	0.23	0.23	0.68	
<i>Downtown</i>					
Number (%)	41 (64)	6 (9)	2 (3)	15 (23)	64
Number/1000 pop.	1.62	0.24	0.08	0.59	
Number/km ²	10.5	1.54	0.51	3.85	
Total	45	7	3	18	73

selected variety stores, eight granted permission to collect price data; though we could not compare the characteristics of the eight that granted permission to the seven that did not as we were not given access to these latter stores, we assume that access was denied due to the differing characteristics of the manager rather than the stores themselves. The eight participating stores were distributed evenly throughout the Downtown area, i.e., there was no particular clustering in one geographical area.

Not all stores stocked all surveyed items. When comparing costs within store types, only items available at 67% or more of stores were included in the comparison. When a store did not stock an item available at over 67% of stores, the average price for all stores carrying the item was assigned to this store. Food basket cost was then totaled and the totals compared. For comparisons between store types, cost differences were evaluated using the smaller list of items (e.g., supermarkets carried more items than variety stores); thus, when comparing costs between these store types, the variety-store food list was used. Fig. 3 shows the items that were included in the various comparisons.

For both the produce and food-cost surveys, all stores that granted access were included in the data analysis, regardless of the number of food and/or produce items they carried. The exception to that rule, though, was the variety stores in the Downtown area that were too numerous to all be included in the cost survey. We did, however, include all consenting variety stores in the produce survey and found that the variety stores did not vary in produce availability; this is another piece of evidence to show that those stores that were not included in the cost survey, due to manager refusal to participate, did

not vary in terms of store characteristics from those whose managers agreed to participate.

The presence or absence of 18 fresh produce items was assessed using a list derived from the ONFB (Fig. 3). All six Uptown and 46 of 49 Downtown non-specialty food outlets were included in the survey; three of the Downtown stores were not included in the produce survey because the managers denied access. Thus, the sample size for the produce availability survey is much greater than for the cost survey. This is primarily due to the fact that this survey could be completed much more quickly and the majority of the owner/managers gave permission to conduct the survey, as they did not feel as threatened by a produce survey, as compared to collecting price information, which was viewed with some suspicion. Because many variety stores were operated by individuals with limited English skills, communication was difficult.

Semi-structured interviews were conducted with food outlet owners and managers to gain insight into how local conditions and consumer demand interacted with larger industry patterns to influence the cost and availability of food in Hamilton. Semi-structured interviews were also conducted with public health professionals in Hamilton—a public health nurse, a public health dietician, and a school nutrition coordinator—who are knowledgeable about issues around poverty, nutrition, and food acquisition.

The semi-structured format is preferred when interview subjects are busy and subsequent interviews are not feasible (Bernard, 1994). The interview questions were tailored for this project consulting Woodward and Chambers (1980), Woodward et al. (1982), Bernard (1994), and Ervin (2000). The interview sample included seven interviews with

oranges
 tomatoes
 apples
 bananas
 grapes
 pears
 raisins
 potatoes
 broccoli
 cabbage
 carrots
 celery
 cucumber
 iceberg lettuce
 Romaine lettuce
 onions
 green peppers
 turnips/rutabagas

Fig. 3. Produce availability survey items.

food outlet owners and managers: two variety-store owner/managers (one Uptown, one Downtown), two grocery-store owner/managers (both Downtown), and two supermarket owner/managers (one Uptown, one Downtown). In addition, three public health professionals were interviewed, for a total of 10 qualitative interviews.

Analysis

Due to the small size and non-normally distributed nature of the food-cost and produce availability data sets, only non-parametric statistical tests were used, and only where sample sizes permitted. The Kruskal–Wallis test was used to compare the distributions of three or more independent groups. Statistical analysis was carried out using SPSS version 10.1 (SPSS Inc.).

Interviews were analysed for emergent themes and to compare and contrast respondents' answers using the NVivo software package (QSR International). Nvivo is a multipurpose software program designed to facilitate the organization and analysis of qualitative data (Bazeley and Richards, 2000).

Results

Food cost and availability

Table 2 shows the distribution of food outlets by type and area. Uptown food outlets are tightly clustered; seven of nine are located along a kilometre stretch of the main street in the area. The Downtown, in contrast, is dominated by evenly

distributed variety stores that make up 64% of food outlets in the area; there are many more variety stores in the Downtown, per resident and per kilometre, than in Uptown. By comparison there are only two supermarkets in the Downtown, meaning that each one must serve nearly twice as many residents as does the Uptown supermarket; i.e., 1/7000 people in Uptown vs. 1/12,500 thousand people in Downtown.

There do not appear to be price differences between the two areas, with the exception of supermarkets: the total cost for all ONFB items at the Uptown supermarket was highest at \$160.22 vs. \$132.35 and \$132.17 at each of the two Downtown supermarkets, amounting to a difference of \$27.96 between the Uptown supermarket and the mean cost of the two Downtown supermarkets. The grocery-store prices ranged from \$119.64 in Uptown to \$111.38, \$127.40, and \$128.35 in the Downtown stores with a mean cost of \$122.38 for the three Downtown grocery stores. Variety-store price data are presented in Table 3. Please note, though, that comparisons by area are limited by the small Uptown sample size. It appears, however, that intra-area variation is greater than inter-area differences.

Rank costs across the three store types were found to be significantly different (Kruskal–Wallis test, $H = 7.878$, $p = 0.019$, $df = 2$). Supermarkets were least expensive; grocery and variety stores were more expensive and similar in cost. The three outlet types stocked different numbers of the 66 ONFB items: the median number for supermarkets was 63 (60 minimum, 64 maximum) while the median for grocery stores was 52.5 (42 minimum, 63 maximum) and for variety stores it was 27.5 (minimum 7,

Table 3
 Cost of Ontario Nutritious Food Basket (ONFB) items available in study area variety stores

Uptown stores	Cost (\$)	Downtown stores	Cost (\$)
1	40.84 min	1	41.30
2	45.31 max	2	37.36 min
Median	43.08	3	41.44
		4	46.19 max
		5	45.18
		6	38.24
		7	38.96
		8	39.57
		Median	39.57

*Only 20 ONFB items were compared since the variety stores did not carry all of the items on the list.

maximum 36). These rankings were significantly different (Kruskal–Wallis test, $H = 11.467$, $p = 0.003$, $df = 2$).

Produce availability

Table 4 presents produce survey results. While ranked differences in number of items stocked by store type are significantly different (Kruskal–Wallis test, $H = 21.582$, $p < 0.000$, $df = 2$), differences between the two areas are not apparent. The most commonly stocked items for all variety stores were onions (42%), potatoes (33%), and bananas (28%).

The structure of the food retail industry in Hamilton

Three findings are discussed here: the ownership structure of food outlets in Hamilton, differences within the supermarket category, and produce availability at variety stores.

Ownership

Three companies own most supermarkets and grocery stores, as well as the two main food distributors in Hamilton. Pricing and stocking decisions were almost invariably made or tightly constrained in corporate or regional offices. The control over the food distribution system in Canada by a few national or multinational companies is common to North America. This may differ, however, in the UK, Europe, and elsewhere.

These decisions influence the price and availability of food at variety stores in several ways. Variety stores often purchase their goods from grocery distributors. Also, variety-store owners use supermarket prices as a guide, as described by a Hamilton variety-store owner (V1):

Obviously, we like to keep [prices] reasonable. And by reasonable, you like to sell [an item] for the price the higher priced supermarkets sell it

for, when it’s not on special. ...I know they offer really excellent services, and the place is really nice and clean, but they also charge a premium for whatever product and my price is usually comparable.

Given the structure of the industry, there is no reason to suspect that this pattern is unique to Hamilton.

Types of supermarket

It was clear from the interviews that the stores classified in this study as supermarkets were of two types, termed here conventional and discount. Both sell a wide array of food and other items, but discount supermarkets stock a smaller number of items, that sell more quickly; in addition, conventional supermarkets often offer other services, such as photo finishing. S1, a discount supermarket franchise owner, explains the strategy: “get the best price on everyday items vs. conventional stores, which charge more. [We] stock 6000 items. [Conventional supermarkets] stock 15–20,000 items. We focus on things that turn over, quick sellers”.

The conventional supermarket strategy is described by S2, who identified the shoppers at his store as “Not the discount shopper... Here, quality is the biggest issue. Quality and service [attract people].” People come here because “we pay more for our products; we go out of our way...to buy the best”. To prove his point, S2 used apples as an example of how the different supermarket types sell different goods:

S2: It’s about standards and grades. Here compared to the discounters, that’s the difference. Size and grade determines price. With apples, we buy your nice 88s or 85s. [Discount supermarkets] buy 110s, something like that. You buy an apple here, it is different than an apple there. Size determines quality.

JL: What are those numbers?

Table 4
Median number of available produce items,^a by store type

Store type	Uptown	Downtown	Combined ^b
Variety stores	0.0 (0 min, 1 max)	1.0 (0 min, 14 max)	1 (0 min, 14 max)
Grocery stores	11	15 (7 min, 17, max)	13 (7 min, 17 max)
Supermarkets	18	17.5 (17 min, 18, max)	18 (17 min, 18 max)

Sample sizes: Uptown: 4 variety, 1 grocery, 1 supermarket; Downtown: 39 variety, 5 grocery, 2 supermarket.

^aA total of 18 produce items was assessed.

^bThe different types of store stock significantly different numbers of produce items (Kruskal–Wallis, $H = 21.582$, $p < 0.000$, $df = 2$).

S2: Those are the sizes, how many you can fit in the box.

Leaving aside the question of whether larger apples really are better apples, the finding that all apples are not the same has important implications for surveys of the type carried out in this study as well as for the wide-ranging food-cost analyses cited in the review of inter-neighbourhood price differences: if conventional and discount supermarkets systematically stock qualitatively different products and preferentially locate in neighbourhoods of differing affluence, as is the case in this study, then the assumption that an apple sold in one supermarket or neighbourhood is equivalent to another is not valid. Without assuming a direction to the differences, it is possible that the different grades of apples and other foods could vary in the amounts of nutrients they provide to consumers. It is also possible that this difference could structure exposure to pesticides or other contaminants that travel on the food, especially if different grades of produce are acquired from different regions and/or countries. Other researchers (Cummins and Macintyre, 2002b; Sooman et al., 1993) have attempted to control for quality using various rating systems; this is discussed below.

In this study, two discount supermarkets are located in the Downtown while the Uptown supermarket and its nearest competition (in an adjacent neighbourhood) are both conventional supermarkets. The different supermarket format between the two areas might explain the observed supermarket cost difference between the two areas. It should be noted that food availability, as measured by the ONFB, did not differ greatly between the Downtown and Uptown supermarkets, and, S1's comments about quality aside, the produce in the Downtown supermarkets appeared to be of equal quality to that in Uptown.

Produce availability and variety stores

Variety stores carry few produce items; the average in this study was 2.28 produce items, the most common of which were onions and potatoes. Given the distribution of store types in Hamilton, produce scarcity is of greatest concern to Downtown residents.

Variety-store owner/managers stated they did not carry fruits and vegetables because (1) it is difficult for a variety-store owner to purchase produce at a price that allows resale at a price attractive to

consumers *and* garners a profit for the store, (2) the problem of spoilage, (3) space is at a premium in the smaller variety stores, and (4) consumers do not expect to purchase produce from a variety store. V2, an Uptown variety-store owner, explained why he did not stock produce:

Because we don't have enough space, first of all, and if we don't sell all of them, then they destroy [spoil], all cost will come to us, and, the big stores, as I know, they sell more fruit and vegetables on very low prices.

V1, who runs a variety store in the Downtown discussed the problem, also mentioning the problem of consumers' expectations:

I have actually attempted [to sell produce] three different times, but I have failed each time. The number of people who come in are limited, and also I haven't had it [in the past], so they don't look for it, and of course, since I do not buy in large volume, it is hard to get it [produce] at decent price.

Public health professionals' perspectives on food access and nutrition

Public health professionals identified what they considered to be fundamental problems and barriers for low-income people in Hamilton to access healthy food. The public health nurse identified lack of transportation as contributing to suboptimal diets.

A public health worker familiar with the area commented:

When talking about food access, one issue is really transportation... In [named a neighbourhood in the Downtown area], you see [children's] wagons full of food, you see bikes with different systems of boxes, or whatever, bringing food home. This is a neighbourhood of bungee buggies [wheeled carts used to transport groceries and laundry]: if you go to the local donut store in the morning, you don't see the cars all lined up by the donut store, what you see is all the bungee buggies with boxes in them...

The public health dietician identified the dearth of larger food outlets in the Downtown area. "Another problem in the Downtown area is we have an area where...we have the fewest grocery stores and [worst] access to grocery stores."

The school nutrition programme coordinator echoed a similar concern:

A lot of grocery stores are closing in Hamilton. There used to be a [name of a large supermarket] downtown; it's no longer there. The Farmers Market is in decline... To get the food, if you don't have the transportation, taking it [food] on the bus is a pain, and not everybody can take it on the bus [for physical reasons].

Thus, all three public health professionals concurred that lack of transportation and lack of availability of large food outlets in the Downtown area contributed to nutrition problems among low-income residents.

Discussion

Food cost and availability

In this study, as in the balance of the literature, food cost is not higher in the low-income area, although this finding is based on a relatively small number of stores within only two contrasting neighbourhoods. Prices varied more between food outlet types than between study areas, with supermarkets having the lowest food costs. The findings for food availability and produce availability are similar to food cost: more items are available at supermarkets, both in terms of food items in general and fresh produce items specifically. Thus, increasing the number of supermarkets available to Downtown residents could conceivably improve diets. The research of Sallis et al. (1986), Morland et al. (2002), and Wrigley et al. (2002) supports this supposition. As discussed above, however, the research of Cummins et al. (2005) and Dibsall et al. (2003) suggests that increasing supermarket access may not be as beneficial for diets as previously believed.

The finding that food cost does not vary greatly between areas for the smaller store types and that Downtown supermarkets are cheaper than the Uptown supermarket should not be taken as evidence that Downtown residents can easily purchase low-cost food. Because of differences in population density, fewer supermarkets per person are available in the Downtown than in Uptown (see Table 2) and few Downtown residents live near a supermarket. In contrast to the dearth of supermarkets in the Downtown, 64% of Downtown food outlets are variety stores offering fewer healthy foods at higher prices.

Unfortunately, Statistics Canada does not collect data on car ownership, so we cannot compare access to car transportation among individuals living in the more-affluent area of Uptown compared to the less-affluent area of Downtown. It stands to reason, however, that lower-income people are less likely to own cars and are thus less able to drive to either local supermarkets or to large retail outlet stores in the suburban parts of the city, where discount prices on food and other goods are available. One piece of evidence, however, comes from the public health nurse, who observed that residents of the Downtown use wagons and shopping carts to transport groceries from supermarkets to home, indicating that many of these consumers most likely do not have access to car transportation.

Fresh produce availability

Numerous studies have found that the consumption of fresh produce promotes health. Interviews with storeowners suggest that produce provision in variety stores is unlikely to increase, as economies of scale, problems with lack of space, consumer expectations, and price competition with other food outlets all work against variety stores selling fresh produce. In addition to availability, the type or size of produce sold may vary with area affluence. This presents problems for the assumptions commonly made in area-comparison studies and also could lead to differences in the nutritional quality or contaminant/pesticide exposure. In their study of food cost and availability, Sooman et al. (1993) rated produce quality at each sampled store on a scale of 1–5, with 5 being the best. Produce quality was slightly higher (3.3 vs. 2.6) in the more-affluent area. Cummins and Macintyre (2002b) used a three-point produce-rating scale to standardize produce comparisons. Incorporating quality measures into comparisons of produce availability is important; however, standardization may not be possible, as the produce on sale in different types of food retailers may systematically differ in nutritional content and contamination risk.

Social and economic strategies to improve public nutrition

In industrialized nations such as Canada, overweight and obesity are the most common results of poor nutrition; Birmingham et al. (1999) estimated that these conditions directly contributed \$1.8

billion, or 2.4% of expenditures, to health care costs in 1997. Considering that other diseases, notably type 2 diabetes and coronary heart disease, can be linked with dietary intakes, the costs, in terms of quality of life and dollars, of poor nutrition can be very high. It is therefore worthwhile to consider various strategies to improve healthy eating.

A variety of strategies to improve public nutrition have been suggested (see Nestle and Jacobson, 2000). Many factors, including social, cultural, and political-economic ones, influence food choice behaviour. Given the nature of this research project, however, we highlight here some economic strategies for purchasing and accessing healthy food for less-affluent people to improve public nutrition.

Brownell and Horgen (2004) discuss taxing snack foods and using the revenue to subsidize the cost of healthier foods. Small-scale studies (French et al., 1997, 2001; Horgen and Brownell, 2002) and the experiences of some US states (Brownell and Horgen, 2004) suggest that this approach might work. One concern is the possible regressive nature of these taxes; further reducing the funds available to low-income individuals and families is unlikely to improve their diets. In addition to whether the public would accept another tax, there is the question of which foods to tax and which to subsidize for maximum public health effect and/or cost effectiveness.

Other programmes to improve access to produce in low-income areas could be pursued. These could include the municipal government granting tax reductions in the Downtown to encourage food companies to establish supermarket outlets in the lower-income area of the city. As well, less-affluent consumers could organize group-purchasing co-operatives, encouraging farmers markets to be open longer hours, or other programmes such as the Good Food Box programme, run by FoodShare Toronto, that makes fresh produce more available to low-income urban residents by providing local neighbourhood drop-off depots. In smaller cities such as Hamilton, partnerships with nearby farms are an option. In the US, some low-income groups receive vouchers allowing them to purchase fruits and vegetables at farmers markets (Just and Weninger, 1997).

Conclusion

Although this study is limited to a small number of stores in two neighbourhoods, in Hamilton, as in

the majority of the reviewed literature, food cost did not appear to vary with area affluence. However, the lower-income area was dominated by variety stores that stocked fewer healthy foods in general and produce items in particular. In this aspect, Hamilton appears to display a pattern of retail provision typical of North American cities. Where this is the case, the constellation of low affluence, reduced access to transportation, and reduced availability of healthy foods (including fresh produce) may make acquiring a healthy diet more difficult for residents of poor neighbourhoods. Links between economics and nutrition are complex; future research into the determinants of healthy eating will need to take into account the dietary, linguistic, and cultural diversity of consumers living in contemporary urban society, along with temporal and spatial variation in food cost and availability.

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References

- Adler, N.E., Ostrove, J.M., 1999. Socioeconomic status and health: what we know and what we don't. In: Adler, N.E., Marmot, M., McEwen, B.S., Stewart, J. (Eds.), *Socioeconomic Status and Health in Industrial Nations: Social, Psychological, and Biological Pathways*. Annals of the New York Academy of Sciences 896, 3–15.
- Alcaly, R.E., Klevorick, A.K., 1971. Food prices in relation to income levels in New York City. *Journal of Business* 44, 380–397.
- Ambrose, D.M., 1979. Retail grocery pricing: inner city, suburban and rural comparisons. *Journal of Business* 52 (1), 95–102.
- Baum, F., 1995. Researching public health: behind the quantitative—qualitative methodological debate. *Social Science & Medicine* 40 (4), 459–468.
- Bazeley, P., Richards, L., 2000. *The Nvivo Qualitative Project Book*. Sage, Thousand Oaks, CA.
- Beaton, G.H., 1989. Small but healthy? Are we asking the right question? *Human Organization* 48 (1), 31–37.
- Bernard, H.R., 1994. *Research Methods in Anthropology: Qualitative and Quantitative Approaches*, second ed. Sage, Thousand Oaks, CA.

- Birmingham, C.L., Muller, J.L., Palepu, A., Spinelli, J.J., Anis, A.H., 1999. The cost of obesity in Canada. *Canadian Medical Association Journal* 160, 483–488.
- Brownell, K.D., Horgen, K.B., 2004. *Food Fight: the Inside Story of the Food Industry, America's Obesity Crisis, and What We Can Do About It*. McGraw-Hill, New York.
- Caplovitz, D., 1963. *The Poor Pay More: Consumer Practices of Low-Income Families*. The Free Press of Glencoe, London.
- Che, J., Chen, J., 2001. Food insecurity in Canadian households. *Health Reports* 12 (4), 11–22.
- Chung, C., Myers, S.L., 1999. Do the poor pay more for food? An analysis of grocery store availability and food price disparities. *The Journal of Consumer Affairs* 33 (2), 276–296.
- Coburn, D., 2004. Beyond the income inequality hypothesis: class, neo-liberalism, and health inequalities. *Social Science & Medicine* 58, 451–456.
- Cotterill, R.W., Franklin, A.W., 1995. *The Urban Grocery Store Gap*. Food Marketing Policy Issue Paper. Food Marketing Policy Center, University of Connecticut.
- Cummins, S., Macintyre, S., 1999. The location of food stores in urban areas: a case study in Glasgow. *British Food Journal* 101 (7), 545–553.
- Cummins, S., Macintyre, S., 2002a. “Food deserts”—evidence and assumption in health policy making. *British Medical Journal* 325, 436–438.
- Cummins, S., Macintyre, S., 2002b. A systematic study of an urban foodscape: the price and availability of food in greater Glasgow. *Urban Studies* 39 (11), 2115–2130.
- Cummins, S., Petticrew, M., Higgins, C., Findlay, A., Sparks, L., 2005. Large-scale food retailing as an intervention for diet and health: quasi-experimental evaluation of a natural experiment. *Journal of Epidemiology and Community Health* 59, 1035–1040.
- Curtis, K.A., McClellan, S., 1995. Falling through the safety net: poverty, food assistance and store opening constraints in an American City. *Urban Anthropology* 24 (12), 93–135.
- Davey-Smith, G., Brunner, E., 1997. Socio-economic differentials in health: the role of nutrition. *Proceedings of the Nutrition Society* 56, 75–90.
- Deaton, A., 2002. Policy implications of the gradient of health and wealth. *Health Affairs* 21 (2), 13–30.
- Dibsdall, L.A., Lambert, N., Bobbin, R.F., Frewer, L.J., 2003. Low-income consumers' attitudes and behaviour towards access, availability and motivation to eat fruit and vegetables. *Public Health Nutrition* 6 (2), 159–168.
- Donkin, A.J.M., Dowler, E.A., Stevenson, S.J., Turner, S.A., 2000. Mapping access to food in a deprived area: the development of price and availability indices. *Public Health Nutrition* 3 (1), 31–38.
- Edmonds, L., 2000. The magic bullet? In: Goodman, A.H., Dufour, D.L., Peltó, G.H. (Eds.), *Nutritional Anthropology: Biocultural Perspectives on Food and Nutrition*. Mayfield Publishing Company, Mountain View, CA, pp. 20–27.
- Eisenhauer, E., 2001. In poor health: supermarket redlining and urban nutrition. *GeoJournal* 53, 125–133.
- Ervin, A.M., 2000. *Applied Anthropology: Tools and Perspectives for Contemporary Practice*. Allyn & Bacon, Boston.
- Facchini, F.S., Humpresh, M.H., DoNascimento, C.A., Abbasi, F., Reaven, G.M., 2000. Relation between insulin resistance and plasma concentrations of lipid hydroperoxides, carotenoids, and tocopherols. *American Journal of Clinical Nutrition* 72, 776–779.
- Feinstein, J.S., 1993. The relationship between socioeconomic status and health: a review of the literature. *The Milbank Quarterly* 71 (2), 1993.
- Fernandez, E., Negri, E., La Vecchia, C., Franceschi, S., 2000. Diet diversity and colorectal cancer. *Preventive Medicine* 31, 11–14.
- Finke, M.S., Chern, W.S., Fox, J.J., 1997. Do the urban poor pay more for food? Issues in measurement. *Advancing the Consumer Interest* 9 (1), 13–17.
- Franceschi, S., Parpinel, M., La Vecchia, C., Favero, A., Talamini, R., Negri, E., 1998. Role of different types of vegetables and fruit in the prevention of cancer of the colon, rectum, and breast. *Epidemiology* 9 (3), 338–341.
- Frankel, D.M., Gould, E.D., 2001. The retail price of inequality. *Journal of Urban Economics* 49, 219–239.
- French, S.A., Jeffrey, R.W., Story, M., Hannan, P., Snyder, M.P., 1997. A pricing strategy to promote low-fat snack choices through vending machines. *American Journal of Public Health* 87 (5), 849–851.
- French, S.A., Jeffrey, R.W., Story, M., Breitlow, K.K., Baxter, J.S., Hannan, P., Snyder, M.P., 2001. Pricing and promotion effects on low-fat vending snack purchases: the CHIPS study. *American Journal of Public Health* 91 (1), 112–117.
- Gleason, P., Suitor, C., 2001. *Children's Diets in the Mid-1990s: Dietary Intake and its Relationship with School Meal Participation*. US Department of Agriculture, Food and Nutrition Service, Office of Analysis, Nutrition and Evaluation, Alexandria, VA.
- Goodman, A.H., Leatherman, T.H., 1998. Traversing the chasm between biology and culture: an introduction. In: Goodman, A.H., Leatherman, T.L. (Eds.), *Building a New Biocultural Synthesis: Political-Economic Perspectives on Human Biology*. University of Michigan Press, Ann Arbor, MI, pp. 3–42.
- Groom, P., 1966. Prices in poor neighborhoods. *Monthly Labor Review* 89, 1085–1090.
- Hayes, L.R., 2000. Do the poor pay more? An empirical investigation of price dispersion in food retailing. Working Paper, 9/12/2000, Department of Economics, Rutgers University.
- Health Canada, 1998. *Ontario Nutritious Food Basket 1998*. Minister of Public Works and Government Services Canada.
- Himmelgreen, D.A., Perez-Escamilla, R., Segura-Millan, S., Peng, Y., Gonzalez, A., Singer, M., Ferris, A., 2000. Food insecurity among low-income Hispanics in Hartford, Connecticut: implications for public health policy. *Human Organization* 59 (3), 334–342.
- Hollington, N., Newby, C., 1995. The increasing cost of a healthy diet. *Food Magazine*, 17.
- Horgen, K.B., Brownell, K.D., 2002. Comparison of price change and health message intervention in promoting healthy food choices. *Health Psychology* 21, 505–512.
- Horton, S., Campbell, C., 1990. Do the poor pay more for food? *Food Market Commentary* 11 (4), 33–39.
- James, W.P.T., Nelson, M., Ralph, A., Leather, S., 1997. The contribution of nutrition to inequalities in health. *British Medical Journal* 314, 154–159.
- Just, R.E., Weninger, Q., 1997. Economic evaluation of the farmers' market nutrition program. *American Journal of Agricultural Economics* 79, 902–918.
- Katzmarzyk, P.T., 2002. The Canadian obesity epidemic, 1985–1998. *Canadian Medical Association Journal* 166 (8), 1039–1040.

- Katzmarzyk, P.T., Craig, C.L., Bouchard, C., 2001. Underweight, overweight, and obesity: relationships with mortality in the 13-year follow-up of the Canadian Fitness Survey. *Journal of Clinical Epidemiology* 54, 916–920.
- Kawachi, I., 2002. Social epidemiology. *Social Science & Medicine* 54, 1739–1741.
- Kendall, A., Kennedy, E., 1998. Position of the American Dietetic Association: domestic food and nutrition security. *Journal of the American Dietetic Association* 98 (3), 337–342.
- Kendall, A., Olson, C.M., Frongillo, E.A., 1996. Relationship of hunger and food insecurity to food availability and nutrition security. *Journal of the American Dietetic Association* 96, 1019–1024.
- Kirkpatrick, S., Tarasuk, V., 2003. The relation between low income and household food expenditure patterns in Canada. *Public Health Nutrition* 6 (6), 589–597.
- Kunreuther, H., 1973. Why the poor pay more for food: theoretical and empirical evidence. *Journal of Business* 46, 368–383.
- Macintyre, S., Ellaway, A., Cummins, S., 2002. Place effects on health: how can we conceptualise, operationalise, and measure them? *Social Science & Medicine* 55, 125–139.
- Mann, G.V., 1994. Metabolic consequences of dietary trans fatty acids. *Lancet* 343, 1268–1271.
- Marcus, B.H., 1969. Similarity of ghetto and nonghetto food costs. *Journal of Marketing Research* VI, 365–368.
- Marmot, M., 1999. Part I summary: overview. In: Adler, N.E., Marmot, M., McEwen, B.S., Stewart, J. (Eds.), *Socioeconomic Status and Health in Industrial Nations: Social, Psychological, and Biological Pathways*. *Annals of the New York Academy of Sciences* 896, 1–2.
- McDonald, J.M., Nelson, P.E., 1991. Do the poor still pay more? Food price variations in large metropolitan areas. *Journal of Urban Economics* 30, 344–359.
- McIntyre, L., 2003. Food security: more than a determinant of health. *Policy Options* 24 (3), 46–51.
- McIntyre, L., Connor, S., Warren, J., 1998. A Glimpse of Child Hunger in Canada. Applied Research Branch Strategic Policy. W-98-26E. Human Research Development Canada.
- Moffat, T., Galloway, T., Latham, J., 2005. Stature and adiposity among children in contrasting neighborhoods in the City of Hamilton, Ontario, Canada. *American Journal of Human Biology* 17, 355–367.
- Mooney, C., 1990. Cost and availability of healthy food choices in a London health district. *Journal of Human Nutrition and Dietetics* 3, 111–120.
- Morland, K., Wing, S., Diez Roux, A., Poole, C., 2001. Neighborhood characteristics associated with the location of food stores and food service places. *American Journal of Preventive Medicine* 22 (1), 23–29.
- Morland, K., Wing, S., Diez Roux, A., 2002. The contextual effect of the local environment on residents' diets: the atherosclerosis risk in communities study. *American Journal of Public Health* 92 (11), 1761–1767.
- National Statistics, 2005. Family Food in 2003–2004. TSO, London. Available at: <<http://statistics.defra.gov.uk/esg/publications/efs/2004/default.asp>>.
- Nestle, M., Jacobson, M.F., 2000. Halting the obesity epidemic: a public health policy approach. *Public Health Reports* 115, 12–24.
- Nevraumont, U., 1987. Where Canadians buy their food and when. *Food Market Commentary* 9 (4), 48–62.
- Power, E.M., 2004. The determinants of healthy eating among low-income Canadians. Scoping Paper prepared for The Office of Nutrition Policy and Promotion, Health Canada.
- Rankin, T., 2001. The cost of healthy eating in Edmonton. Master's Thesis, University of Alberta.
- Rimm, E.B., Ascherio, A., Giovannucci, E., Spiegelman, D., Stampfer, M.J., Willet, W.C., 1996. Vegetable, fruit, and cereal fiber intake and risk of coronary heart disease among men. *Journal of the American Medical Association* 275 (6), 447–451.
- Robertson, A., Brunner, E., Sheiham, A., 1999. Food is a political issue. In: Marmot, M., Wilkinson, R.G. (Eds.), *Social Determinants of Health*. Oxford University Press, Oxford, pp. 179–210.
- Sallis, F., Nader, P.R., Rup, J.W., Atkins, C.J., Wilson, W.J., 1986. San Diego surveyed for heart-healthy foods and exercise facilities. *Public Health Reports* 101 (2), 216–219.
- Scrimshaw, N.S., 2000. Iron deficiency. In: Goodman, A.H., Dufour, D.L., Pelto, G.H. (Eds.), *Nutritional Anthropology: Biocultural Perspectives on Food and Nutrition*. Mayfield Publishing Company, Mountain View, CA, pp. 252–257.
- Smith, J.P., 1999. Healthy bodies and thick wallets: the dual relationship between health and economic status. *Journal of Economic Perspectives* 13 (2), 145–166.
- Sooman, A., Macintyre, S., Anderson, A., 1993. Scotland's health—a more difficult challenge for some? The price and availability of healthy foods in socially contrasting localities in the West of Scotland. *Health Bulletin* 51 (5), 276–284.
- Statistics Canada, 2001. 2001 Census of Canada. Electronic Document. <<http://estat.statcan.ca/content/english/over.htm>> (accessed December 2003 to March 2004).
- Statistics Canada, 2003. Census Geography. <http://geodepot.statcan.ca/Diss/Reference/COGG/ShortDescription_e.cfm?GEO_LEVEL=12&TUTORIAL=1&ABBRV=CT> (accessed in December 2005).
- Steinmetz, K.A., Potter, J.D., 1996. Vegetables, fruit and cancer prevention: a review. *Journal of the American Dietetic Association* 96, 1027–1039.
- Tarasuk, V.S., Beaton, G.H., 1999. Women's dietary intakes in the context of household food insecurity. *Journal of Nutrition* 129, 672–679.
- Travers, K.D., Cogdon, A., McDonald, W., Wright, C., Anderson, B., Maclean, D.R., 1997. Availability and cost of heart healthy dietary changes in Nova Scotia. *Journal of the Canadian Dietary Association* 58, 176–183.
- Tufts Nutrition Center on Hunger, Poverty, and Nutrition Policy, 1998. Statement on the Link Between Nutrition and Cognitive Development in Children 1998. Electronic Document. <<http://nutrition.tufts.edu/publications/hunger/pub/statement.shtml#ove>> (accessed 14 March 2003).
- Turrell, G., Hewitt, B., Patterson, C., Oldenburg, B., Gould, T., 2002. Socioeconomic differences in food purchasing behavior and suggested implications for diet-related health promotion. *Journal of Human Nutrition and Dietetics* 15, 355–364.
- Williams, D.E.M., Wareham, N.J., Cox, B.D., Byrne, C.D., Hales, N., Day, N.E., 1999. Frequent salad vegetable consumption is associated with a reduction in the risk of diabetes mellitus. *Journal of Clinical Epidemiology* 52 (4), 329–335.
- Winkler, E., Turrell, G., Patterson, C., in press. Does living in a disadvantaged area mean fewer opportunities to purchase

- fresh fruit and vegetables in the area. Findings from the Brisbane food study. *Health & Place*.
- Woodward, C.A., Chambers, L.W., 1980. *Guide to Questionnaire Construction and Question Writing*. Canadian Public Health Association, Ottawa.
- Woodward, C.A., Chambers, L.W., Smith, K.D., 1982. *Guide to Improved Data Collection in Health and Health Care Surveys*. Canadian Public Health Association, Ottawa.
- Wrigley, N., Warm, D., Margetts, B., Whelan, A., 2002. Assessing the impact of improved retail access on diet in a 'food desert': a preliminary report. *Urban Studies* 39 (11), 2061–2082.
- Zheng, W., Blot, W.J., Shu, X., Gao, Y., Ji, B., Ziegler, R.G., Fraumeni, J.F., 1992. Diet and other risk factors for laryngeal cancer in Shanghai, China. *American Journal of Epidemiology* 136 (2), 178–191.