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Neighbourhood Provision of Food and Alcohol Retailing and Social Deprivation in Urban New Zealand

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ABSTRACT Recent research has considered whether a range of social and physical characteristics of residential neighbourhoods are important in explaining social and spatial inequalities in health. One strand of this research has investigated the role of neighbourhood access to retail provision of healthy and affordable food. In this national study we used Geographical Information Systems (GIS) to examine the association between food retail (supermarkets, convenience stores and fast food outlets) and licensed alcohol outlet locations, and an area measure of deprivation for urban neighbourhoods across New Zealand. We found that contrary to the international evidence, for all outlet types, access to a range of retail options tended to be better in more deprived neighbourhoods. The implications of this socio-spatial distribution of food and alcohol retailing in reducing health inequalities are discussed.

内容提要: 最新的研究试图探明居民区的社会环境和地理环境是否对社会和空间的健康不平等产生重要影响。其中一项研究考察在居民区中能否获得价格适中的健康食品对这一方面的影响。我们在这项全国性的研究中利用地理信息系统 (GIS), 研究新西兰全国各地食品零售 (超市、便利店和快餐点) 及酒类出售点与城市居民区剥夺程度之间的关系。我们发现新西兰的情况与其他国家相反, 在剥夺程度较高的地区, 一系列零售品较为丰富。本文讨论了食品和酒类零售的这种社会—空间分布对减少健康不平等的意义。

KEY WORDS: Neighbourhoods, health, food retailing, alcohol retailing, Geographical Information Systems

Introduction

Research in a number of countries has firmly established strong geographical inequalities in health between areas of differing socio-economic disadvantage (Davey Smith *et al.*, 2002). This large body of literature has overwhelmingly demonstrated that more deprived

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communities tend to have poorer health than less deprived areas, and that this gap is widening (Shaw *et al.*, 1999). For example, work in the USA, UK and New Zealand has shown that inequalities in health according to area of residence increased steadily during the 1980s and 1990s (Shaw *et al.*, 1999; Davey Smith *et al.*, 2002; Pearce & Dorling, 2006; Singh & Siahpush, 2006). However, although considerable attention has been paid to monitoring these geographical trends, the explanation as to why health has become more spatially polarised remains less clear.

Since the early 1990s there has been a renewed interest among geographers, epidemiologists and public health researchers in the role of neighbourhood factors in explaining geographical variations in health (Macintyre *et al.*, 1993, 2002). A number of studies using multilevel analyses and routinely collected census and social survey data have provided evidence that the characteristics of neighbourhoods exert an influence upon certain health outcomes, independently of the individual characteristics of residents (Pickett & Pearl, 2001). Whilst there is a general consensus that neighbourhoods are important in explaining individual health outcomes, there remains considerable uncertainty as to how neighbourhoods affect health, what the mechanisms are that relate place to health, the critical neighbourhood characteristics and how to measure these characteristics (Diez Roux, 2001). A range of social and physical neighbourhood characteristics have been considered. In particular, there has been an extensive focus on the influence of the physical infrastructure or community resource access in explaining why health varies between deprived and non-deprived communities (Kawachi & Berkman, 2003).

It has been suggested that socially differentiated accessibility to various aspects of 'everyday' health-related features within neighbourhoods, such as parks, recreational opportunities and shops selling healthy food, may help to explain why health varies between different neighbourhoods (Macintyre *et al.*, 1993). For example, a study of eight European countries found that access to resources such as high levels of greenery, and low levels of graffiti and litter in residential environments were associated with being physically active and not being overweight (Ellaway *et al.*, 2005). Other researchers have considered the beneficial and detrimental health effects of geographical access to alternative forms of community resources such as primary (Haynes *et al.*, 2003) or secondary (Arcury *et al.*, 2005) health care provision.

Furthering our understanding of how the local environment influences health is important because of the potential policy implications of the findings. If aspects of the physical infrastructure are a key component of the wider determinants of health, then there may be considerable scope to improve health through targeted environmental interventions. This is an assumption that underlies various urban renewal approaches and the WHO Healthy Cities program, which may have considerable potential to address health inequalities between neighbourhoods and modify the health status of a large group of people (Davies & Kelly, 1993; Blackman, 2006). The current research focuses upon neighbourhood access to food retail provision, which has been noted for shaping the dietary intake of local residents. The aim of this study is to examine the association between access to a range of food and alcohol retail options and neighbourhood deprivation in urban New Zealand. We consider whether the choice and availability of supermarkets, convenience stores, fast food outlets and alcohol vendors is better in more deprived urban settings. This study builds upon previous New Zealand work that has examined neighbourhood access to the *closest* food and fast food outlet (Pearce *et al.*, 2007a). The current study extends previous research by evaluating the *range* of food outlet options within neighbourhoods across urban areas of the

country and is the first New Zealand study to examine the distribution of alcohol outlets. Geographic Information System (GIS) methods are used to measure neighbourhood access to a range of food retail options, and the results are compared to an index of neighbourhood deprivation. We begin with a review of the studies examining neighbourhood access to food retail options before moving on to our methods, results and discussion.

Neighbourhood Access to Retail Food Stores and Alcohol Outlets

Dietary intake is strongly patterned by socio-economic measures with people on higher incomes, higher educational attainment and living in areas of low social deprivation tending to consume or procure more nutritious food items (Davey Smith & Brunner, 1997). The explanations for these patterns of dietary choices are complex and related to a number of factors including food knowledge, food-related cultural practices, the cost of food and the availability of different types of food (Turrell, 1996; Donkin *et al.*, 2000; Turrell *et al.*, 2002). Whilst there has been a considerable focus on individual factors affecting dietary choices, there has been less attention on the environmental or contextual explanations. This has led to calls for more research on the 'obesogenic' environments and the role that local environments play in promoting or undermining healthy eating and healthy levels of physical activity (Egger & Swinburn, 1997). With respect to healthy food environments, researchers have paid particular attention to the impact of neighbourhood access to shops and outlets selling healthy and unhealthy food on people's diet.

Although few studies have considered whether geographical access to food shops actually matters with respect to diet, the evidence that is available suggests that poor access to food shopping facilities has a negative implication for dietary quality. For example, a study of fruit and vegetable intake in 221 neighbourhoods in the USA found that for each additional supermarket in the neighbourhood, fruit and vegetable consumption increased by 32 per cent for black Americans and 11 per cent for white Americans (Morland *et al.*, 2002a). Similarly, other work has found that worse geographical access to food shops may have detrimental repercussions for the quality of diet among specific groups including lower-income African-American women (Zenk *et al.*, 2005a) and pregnant women (Laraia *et al.*, 2004). There is also evidence that good locational access to shops selling healthy food options influences health outcomes such as a lower prevalence of obesity and overweight (Maddock, 2004; Moore & Diez Roux, 2006).

The evidence that nutrition and nutrition-related health outcomes vary between social and ethnic groups and that these health-related behaviours and outcomes are influenced by neighbourhood access to food retail provision, has led some researchers to question whether a social gradient exists in access to food retail provision. There has been considerable interest in how access to food shops is differentially distributed by neighbourhood measures of socio-economic status or in other words whether there is a presence of what has become termed a 'food desert' (Clarke *et al.*, 2002; White, 2007). The strongest evidence for food deserts comes from the USA where the bulk of studies have found neighbourhood disparities in access to food retailing. For example, there is evidence that wealthier and white-dominated neighbourhoods often have a greater concentration of larger supermarkets than poorer and minority neighbourhoods, whilst poorer and minority areas often have greater numbers of smaller grocery stores where the cost of food tends to be higher (Alwitt & Donley, 1997; Chung & Myers, 1999; Morland *et al.*, 2002b). A study within three states found that predominantly ethnic minority and racially mixed neighbourhoods had over twice

as many convenience stores as predominantly white neighbourhoods and half as many larger supermarkets. Further, low-income neighbourhoods had 4 times as many grocery stores but half as many supermarkets than wealthier neighbourhoods (Moore & Diez Roux, 2006). Research has also shown that inequalities in access appear to be growing in the USA as larger supermarkets shift away from poorer inner city areas increasing the likelihood of food deserts developing (Alwitt & Donley, 1997; Zenk *et al.*, 2005b).

Research suggesting that healthy food retail options favour more wealthy neighbourhoods is not limited to studies of supermarkets and convenience stores as researchers have also considered whether access to fast food restaurants and outlets selling alcohol is patterned in a similar way. For example, a study in New Orleans noted that fast food outlet density was higher in low-income neighbourhoods and communities with a higher percentage of black residents (Block *et al.*, 2004). Similarly, a study across four states found that there were 3 times fewer alcohol outlets in the wealthiest neighbourhoods compared to the poorest. However, the same study also found that there was no consistent relationship between fast food restaurants and either the ethnic composition or wealth of the neighbourhoods (Morland *et al.*, 2002b).

Outside of the USA, the evidence for food deserts is more mixed (Cummins & Macintyre, 2006). Early work in Glasgow supported the existence of food deserts (Sooman & Macintyre, 1992; Ellaway & Macintyre, 2000) but not more recent work (Cummins & Macintyre, 1999, 2002). On the other hand, results of work in Leeds have generally been supportive of food deserts (Clarke *et al.*, 2002; Whelan *et al.*, 2002). Both research teams studied the effects of a new supermarket opening in a deprived area on the diet of the local community. The Glasgow group found no difference in diet (Cummins *et al.*, 2005a) whereas the Leeds group found a small improvement (Wrigley *et al.*, 2002, 2003). Other work in Britain (Pearson *et al.*, 2005), Canada (Smoyer-Tomic *et al.*, 2006) and Australia (Winkler *et al.*, 2006) has been unresponsive of the presence of food deserts. For example, Australian-based research found no systematic association between the location of fresh fruit and vegetable outlets and the socio-economic composition in areas of Brisbane (Winkler *et al.*, 2006).

Few studies outside of the USA have considered whether access to fast food restaurants or alcohol outlets varies by neighbourhood deprivation. A cross-sectional analysis of the mean number of McDonald's restaurants per 1000 people in England and Wales demonstrated that there was greater outlet density in deprived neighbourhoods (Cummins *et al.*, 2005b). Similarly, people living in the lowest income communities in Melbourne, Australia had 2.5 times the exposure to fast food outlets than people living in the highest income communities (Reidpath *et al.*, 2002).

Investigators in New Zealand have only recently begun to contribute to neighbourhoods and health literature, and there is little work examining the systematic variations in health-related features of the built environment across neighbourhoods with different socio-economic characteristics. An Auckland study that used a composite index of community resource access which included supermarkets and convenience stores, found a social gradient in access to resources that favoured more deprived neighbourhoods (Field *et al.*, 2004). These findings were subsequently supported by a national study that indicated geographical access to a range of community resources including supermarkets and convenience stores is considerably better in more deprived neighbourhoods (Pearce *et al.*, 2007b). This is perhaps surprising given the results found outside of New Zealand. Another study has found that access to fast food restaurants (multinational chains and locally operated outlets) is patterned in a similar way (Pearce *et al.*, 2007a).

However, much of the earlier work on neighbourhood access to food retailing is limited by the methods used to measure access. Most previous studies have relied upon the simple presence or absence of a facility usually within an administrative unit such as is used for the dissemination of census data. This is a limitation because residents of neighbourhoods may not rely solely upon the facilities within the administrative area in which they reside but rather utilise facilities beyond these arbitrary units. This issue is particularly pertinent for those residents living close to the boundary of an administrative unit. Other studies, including the work in New Zealand have focused on geographical access to the closest food retail option rather than considering the range of opportunities within the neighbourhood (Pearce *et al.*, 2006). Only a handful of studies have used GIS methods such as buffers to more accurately represent the sphere of influence of each neighbourhood which will often extend beyond the boundaries of an administrative unit (Block *et al.*, 2004; Algert *et al.*, 2006; Winkler *et al.*, 2006) and very few studies have been undertaken at the national level.

Data and Methods

Data

Data on the location of all supermarkets, convenience stores (including service stations selling fresh food), fast food restaurants (multinational and locally operated) and alcohol outlets were collected across New Zealand (Table 1). The addresses of the larger and chain supermarkets were obtained from each company's web page and verified using the online telephone directory. Data on local convenience stores and service stations selling fresh food as well as multinational and locally operated fast food restaurants were collected from the 74 Territorial Authorities (TAs) across New Zealand. TAs have regulatory responsibility for the hygiene inspection of all premises in their region used in the manufacture, preparation or storage of food for sale. Data on alcohol outlets were obtained from the Liquor Licensing Authority who collect the data from the 74 District Licensing Agencies across the country. For each outlet, information was obtained on the street address as well as the name of the outlet. All outlets were geocoded to provide a precise geographic coordinate of an outlet's location, which allowed us to identify the census meshblock in which it was located. Meshblocks are the smallest unit of dissemination for New Zealand census data: there are 38 350 meshblocks across the country, each representing approximately 100 people.

Table 1. Sources of food and alcohol outlets data in New Zealand

Outlet type	Source of data	Year collected	Number of coded facilities
Supermarkets	Company websites	2004	372
Convenience stores	Territorial local authorities	2004	2473
Fast food outlets (total)	Territorial local authorities,	2005	2223
Multinational	telephone directories		395
Locally operated			1828
Alcohol licensed outlets (total)	Territorial local authorities,	2005	3544
Hotels, taverns, clubs	company websites, telephone		2226
Bottle stores	and business directories		770
Supermarkets/grocery stores			548

The geocoding success rate was high, ranging from 95.4 per cent for the alcohol outlets to 99.9 per cent for the convenience stores.

Analyses

Statistics New Zealand's Urban–Rural Profile classification (Statistics New Zealand, 2005) was used to identify all of the urban meshblocks across the country. The index categorises all census meshblocks across New Zealand into one of seven urban/rural categories: main urban areas, satellite urban areas with metropolitan links, independent urban areas, and rural areas with high, medium and low urban influence together with remote rural locations. In total there are 22 780 meshblocks classified as being located in a main urban area (Table 2). All subsequent analyses considers only these urban meshblocks.

The analysis was undertaken in two stages. First, the number of food retail and licensed liquor outlets per 10 000 persons were calculated for meshblocks divided into quintiles of social deprivation. Deprivation was measured using the 2001 New Zealand Deprivation Index (NZDep 2001) calculated from census data on nine socio-economic characteristics (e.g. car access, tenure and benefit receipt) (Salmond & Crampton, 2002). The index was used to assign a quintile rank to all meshblocks in the main urban areas of New Zealand. The total number of outlets and the total resident population were extracted for each quintile to calculate the number of outlets per 10 000 population. In addition, Pearson correlation analysis was used to assess the extent and direction of the relationship between the NZDep 2001 index and the food and alcohol outlet rates. All of the analysis was stratified into retail outlet types: supermarkets, convenience stores, fast food venues (local or multinational) and liquor outlets (clubs, hotels/taverns and bottle stores). The small number of meshblocks without an NZDep 2001 score and/or a zero population were excluded from the analysis.

The second stage of the analysis examined the relationship between neighbourhood access to a range of food retail options and neighbourhood deprivation. Using GIS methods, buffers with a Euclidean radius of 800 and 3000 metres were constructed around the population-weighted centroid of each meshblock (the population centre of the meshblock rather than the geometric centre) and the total numbers of food retail and alcohol outlets within each buffer were calculated (Figure 1). These two distances were selected to characterise neighbourhood locational accessibility because previous studies

Table 2. Main urban areas of New Zealand in 2001 and number of food and alcohol outlets

Main urban centre	Total usual resident population	Number of meshblocks	Number of food retail/licensed liquor outlets
Auckland	1 074 309	7863	2170/1160
Wellington—Hutt Valley	292 344	3053	724/443
Christchurch	333 885	2882	529/564
Dunedin	107 079	1210	125/227
Other:	846 192	7766	1520/1160
Whangarei, Hamilton, Tauranga, Rotorua, Gisbourne, Napier-Hastings, New Plymouth, Whanganui, Palmerston North, Porirua, Kapiti, Nelson, Invercargill			
Total	2 653 809	22 774	5068/3354

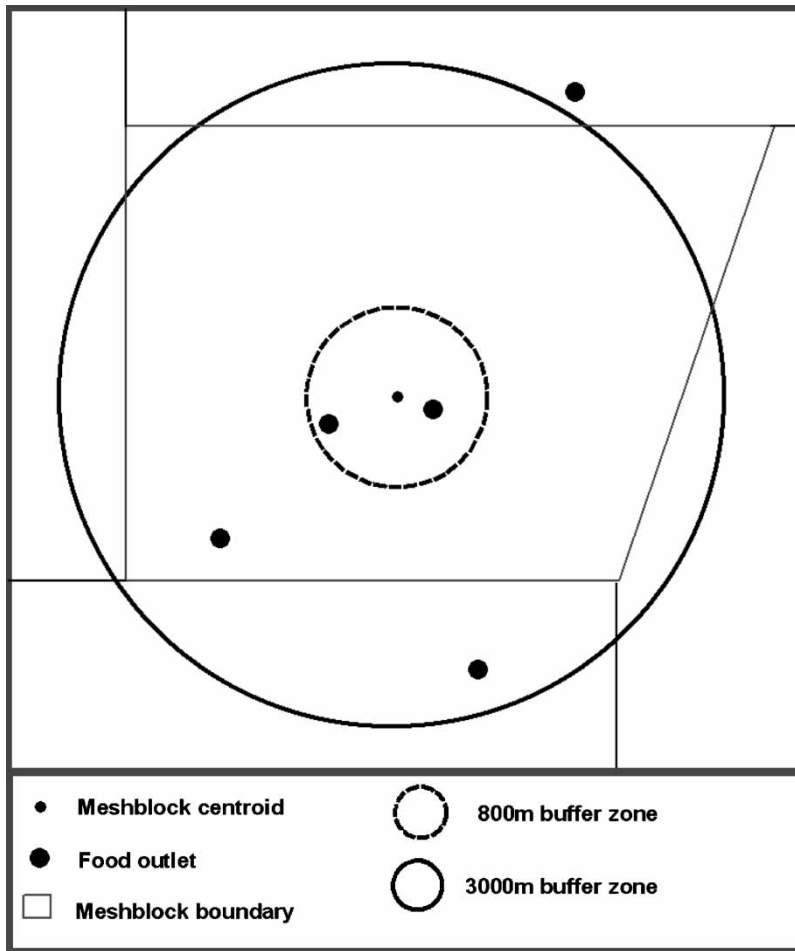


Figure 1. Schematic outline of the buffer analysis procedure

have suggested that they approximate a maximum walking distance (800 metres or 10 minute walk) and typical driving distance to neighbourhood stores (Donkin *et al.*, 2000; Austin *et al.*, 2005; Algert *et al.*, 2006). For each of these neighbourhood definitions, the number and proportion of each type of outlet were calculated for the deprivation quintiles. Therefore, for example, for neighbourhoods with one supermarket within each buffer, the number and proportion of meshblocks with a single supermarket was stratified by deprivation quintiles.

Results

An examination of the relationship between the number of food and alcohol outlets per 10 000 population and social deprivation for meshblocks located in the main urban areas across New Zealand shows a clear social gradient (Table 3). The number of locations per 10 000 population for supermarkets, convenience stores, fast food outlets (multinational and locally operated) and alcohol outlets (all types) generally increase across neighbourhoods

Table 3. Food and alcohol outlets per 10 000 population in main urban areas in meshblocks divided into deprivation quintiles

	N	Deprivation quintile					Ratio Q5:Q1	r^a	p-Value
		1 Low	2	3	4	5 High			
Supermarkets	372	0.6	1.0	1.3	1.9	2.1	3.37	0.99	0.00
Convenience stores	2473	4.1	6.8	11.3	12.2	12.8	3.09	0.95	0.01
Fast food outlets	2223	3.1	5.9	10.3	11.6	11.7	3.82	0.94	0.02
Multinational	395	0.4	0.7	1.7	2.4	2.4	6.36	0.96	0.01
Local	1828	2.7	5.1	8.6	9.2	9.3	3.46	0.93	0.02
Alcohol licensed outlets ^b	3544	4.0	8.1	15.1	20.3	20.1	4.99	0.96	0.01
Hotels, taverns, clubs	2226	1.9	4.5	9.3	13.5	13.3	7.07	0.97	0.01
Bottle stores	770	1.1	2.3	3.6	3.8	3.9	3.51	0.92	0.02
Supermarkets/ grocery stores	548	1.0	1.4	2.2	3.0	2.8	2.76	0.95	0.01

^a Pearson correlation coefficients.^b Includes on and off premise licences.

stratified from low to high deprivation. The strength of these relationships is high as the ratios of the prevalence of outlets in deprivation quintile five compared to quintile one ranged from 2.76 (supermarkets and grocery stores selling alcohol) to 7.07 (hotels, taverns and clubs). These values suggest that prevalence rates are at least 2.76 times greater in more deprived neighbourhoods. Further, the Pearson correlation coefficients were at least 0.92 and all of the relationships were statistically significant ($p < 0.05$).

Although these results demonstrate that there is a higher prevalence of outlets in more deprived areas, the analysis is restricted to considering only the outlets located within the meshblock boundaries. Therefore, to provide an indication of the range of outlets within walking distance and a short drive time of each neighbourhood, buffers with distances of 800 and 3000 metres were constructed around each meshblock centroid and the count of each outlet type within the buffer calculated. More than half of the neighbourhoods ($n = 13\,559$) in urban New Zealand do not have a supermarket within an 800 metre radius (Table 4). Of these neighbourhoods there is a slightly higher proportion (25 per cent) in the least deprived quintile compared to the most deprived quintile (18 per cent). Conversely, among neighbourhoods with one, two, three or more than four supermarkets, the ratio of neighbourhoods in quintile five compared to quintile one is above one, which suggests that there are a greater proportion of neighbourhoods with access to one or more supermarkets in the more deprived quintiles. For example, in neighbourhoods with three supermarkets within 800 metres, there are 49 neighbourhoods in quintile one (low deprivation) compared to 186 neighbourhoods in quintile five (high deprivation). Similarly, among the 3923 neighbourhoods without a convenience store within an 800 metre radius, 39 per cent are in deprivation quintile one (low deprivation) compared to only 9 per cent in quintile five (high deprivation). For neighbourhoods with three or more stores, the ratio of the proportion of neighbourhoods in quintile five compared to quintile one is above one, and the ratio value increased as the number of stores increased. For example, among neighbourhoods with six or more stores there are more than 3 times as many neighbourhoods in the most deprived quintile compared to the least deprived.

Table 4. Relationship between neighbourhood deprivation and number of outlets within an 800 metre buffer—urban areas only

No. of outlets	Deprivation quintile					Total	Ratio Q5:Q1
	Q1	Q2	Q3	Q4	Q5		
Supermarkets							
0	25.2 (3422)	20.5 (2773)	18.3 (2480)	17.8 (2408)	18.3 (2476)	100.0 (13 559)	0.72
1	15.7 (1023)	17.5 (1140)	20.7 (1351)	22.9 (1495)	23.3 (1521)	100.0 (6530)	1.49
2	9.8 (192)	15.1 (296)	21.6 (424)	26.1 (512)	27.4 (538)	100.0 (1962)	2.80
3	8.7 (49)	9.8 (55)	17.8 (100)	30.5 (171)	33.2 (186)	100.0 (561)	3.80
4 +	0.8 (1)	12.0 (15)	13.6 (17)	17.6 (22)	56.0 (70)	100.0 (125)	70.00
Convenience stores							
0	39.2 (1538)	25.2 (988)	15.5 (608)	11.1 (437)	9.0 (352)	100.0 (3923)	0.23
1	25.6 (813)	19.8 (629)	19.5 (619)	18.3 (580)	16.8 (533)	100.0 (3174)	0.66
2	21.7 (661)	18.5 (564)	20.1 (612)	17.6 (536)	22.0 (670)	100.0 (3043)	1.01
3	18.9 (527)	19.4 (540)	19.3 (538)	21.2 (590)	21.2 (592)	100.0 (2787)	1.12
4	17.7 (423)	17.9 (429)	19.3 (463)	22.4 (536)	22.7 (544)	100.0 (2395)	1.29
5	13.0 (264)	15.2 (308)	20.3 (410)	23.8 (481)	27.7 (560)	100.0 (2023)	2.12
6 +	8.5 (461)	15.2 (821)	20.8 (1122)	26.9 (1448)	28.6 (1540)	100.0 (5392)	3.34
Fast food							
0	36.4 (1889)	22.8 (1184)	16.1 (834)	13.2 (684)	11.5 (599)	100.0 (5190)	0.32
1	21.7 (883)	19.8 (804)	18.1 (735)	20.0 (814)	20.3 (824)	100.0 (4060)	0.93
2	17.8 (591)	18.9 (629)	20.5 (683)	21.2 (706)	21.6 (718)	100.0 (3327)	1.21
3	16.3 (374)	18.6 (427)	20.4 (467)	18.6 (427)	26.1 (598)	100.0 (2293)	1.60
4	16.9 (262)	17.1 (264)	20.7 (320)	21.4 (331)	23.9 (370)	100.0 (1547)	1.41
5	13.4 (174)	18.7 (243)	21.2 (276)	23.4 (304)	23.2 (302)	100.0 (1299)	1.74
6 +	10.2 (514)	14.5 (728)	21.1 (1057)	26.7 (1342)	27.5 (1380)	100.0 (5021)	2.68
Alcohol outlets							
0	33.0 (1863)	22.6 (1279)	16.9 (954)	15.3 (865)	12.2 (691)	100.0 (5652)	0.37
1	24.7 (766)	19.1 (593)	18.6 (577)	18.5 (573)	19.1 (593)	100.0 (3102)	0.77
2	21.4 (657)	19.0 (585)	19.2 (592)	19.0 (585)	21.4 (657)	100.0 (3076)	1.00
3	18.2 (417)	19.6 (448)	18.8 (429)	19.7 (451)	23.7 (542)	100.0 (2287)	1.30
4	15.4 (243)	17.7 (280)	22.1 (350)	20.8 (329)	24.0 (379)	100.0 (1581)	1.56
5	16.9 (181)	16.8 (180)	20.1 (216)	22.1 (237)	24.1 (259)	100.0 (1073)	1.43
6 +	9.4 (560)	15.3 (914)	21.0 (1254)	26.3 (1568)	28.0 (1670)	100.0 (5966)	2.98

Table shows the proportion and count (in parentheses) of neighbourhoods with 0, 1, 2, etc. outlets within 800 metres of its centroid, by deprivation quintile.

The results for both fast food and alcohol outlets are broadly consistent with those for supermarkets and convenience stores. Among those neighbourhoods with a small number of outlets within 800 metres (zero or one) there are a greater proportion of neighbourhoods in the less deprived areas. In neighbourhoods with a greater number of outlets (more than three), a greater proportion of neighbourhoods were highly deprived.

Not surprisingly, using a larger 3000 metre buffer tended to capture a greater number of outlets. However, although more outlets were captured, the trends across deprivation quintiles were broadly consistent with those noted using the 800 metre buffer (Table 5). In neighbourhoods with a low number of outlets (supermarkets, convenience stores, fast food and alcohol) the ratio of neighbourhoods in deprivation quintile five compared to quintile one is less than one. Among neighbourhoods with a greater range of outlets, the

Table 5. Relationship between neighbourhood deprivation and number of outlets within a 3000 metre buffer—urban areas only

	Deprivation quintile						Ratio
No. of outlets	Q1	Q2	Q3	Q4	Q5	Total	Q5:Q1
Supermarkets							
0	38.5 (448)	30.5 (355)	14.4 (167)	9.7 (113)	6.9 (80)	100.0 (1163)	0.18
1–3	24.7 (1941)	20.2 (1587)	18.7 (1464)	18.2 (1429)	18.2 (1427)	100.0 (7848)	0.74
4–6	18.4 (1497)	18.0 (1469)	19.7 (1606)	21.4 (1749)	22.5 (1834)	100.0 (8155)	1.23
7–9	13.9 (541)	16.0 (621)	19.7 (765)	23.8 (924)	26.6 (1033)	100.0 (3884)	1.91
10+	15.4 (260)	14.6 (247)	21.9 (370)	23.3 (393)	24.7 (417)	100.0 (1687)	1.60
Convenience stores							
0–10	32.7 (1274)	25.5 (995)	18.6 (724)	14.5 (565)	8.8 (343)	100.0 (3901)	0.27
11–20	22.0 (924)	19.2 (803)	18.9 (792)	18.3 (767)	21.6 (907)	100.0 (4193)	0.98
21–30	17.4 (743)	17.0 (728)	18.7 (800)	21.7 (930)	25.2 (1078)	100.0 (4279)	1.45
31–40	18.5 (564)	18.0 (550)	18.7 (571)	20.5 (626)	24.3 (740)	100.0 (3051)	1.31
41–50	19.5 (409)	15.0 (315)	17.8 (372)	20.0 (418)	27.7 (580)	100.0 (2094)	1.42
51–60	18.6 (232)	16.3 (204)	19.8 (247)	22.0 (274)	23.3 (291)	100.0 (1248)	1.25
61+	13.6 (541)	17.2 (684)	21.8 (866)	25.9 (1028)	21.5 (852)	100.0 (3971)	1.57
Fast food							
0–10	29.0 (1335)	24.3 (1118)	18.2 (838)	15.3 (707)	13.3 (612)	100.0 (4610)	0.46
11–20	23.4 (910)	18.3 (713)	20.0 (779)	20.5 (798)	17.8 (692)	100.0 (3892)	0.76
21–30	21.2 (884)	17.8 (745)	17.2 (720)	18.1 (756)	25.6 (1069)	100.0 (4174)	1.21
31–40	16.0 (532)	18.2 (606)	19.3 (644)	22.0 (734)	24.5 (818)	100.0 (3334)	1.54
41–50	15.9 (335)	16.9 (357)	19.4 (409)	24.1 (508)	23.7 (500)	100.0 (2109)	1.49
51–60	10.2 (132)	13.0 (169)	20.5 (266)	23.7 (308)	32.5 (422)	100.0 (1297)	3.20
61+	16.8 (559)	17.2 (571)	21.6 (716)	24.0 (797)	20.4 (678)	100.0 (3321)	1.21
Alcohol outlets							
0–20	27.5 (2047)	22.5 (1675)	19.6 (1458)	17.8 (1321)	12.6 (940)	100.0 (7441)	0.46
21–40	18.2 (1142)	16.9 (1062)	16.6 (1042)	19.1 (1201)	29.1 (1829)	100.0 (6276)	1.60
41–60	15.5 (535)	18.4 (636)	21.4 (738)	22.6 (780)	22.1 (761)	100.0 (3450)	1.42
61–80	17.5 (317)	16.0 (290)	20.3 (367)	22.5 (406)	23.7 (428)	100.0 (1808)	1.35
81–100	15.5 (105)	14.6 (99)	14.5 (98)	24.4 (165)	30.9 (209)	100.0 (676)	1.99
101–120	13.1 (68)	10.8 (56)	20.6 (107)	25.0 (130)	30.6 (159)	100.0 (520)	2.34
121+	18.4 (473)	18.0 (461)	21.9 (562)	23.6 (605)	18.1 (465)	100.0 (2566)	0.98

Table shows the proportion and count (in parentheses) of neighbourhoods with 0, 1, 2, etc. outlets within 3000 metres of its centroid, by deprivation quintile.

ratio (quintile five:quintile one) is greater than one, which suggests that there are a greater proportion of deprived neighbourhoods in this group. However, it is noticeable that for neighbourhoods with the largest count of alcohol outlets within the 3000 metre buffer (more than 121 outlets) the ratio between deprivation quintiles five and one is 0.98 which suggests that there is little evidence for a social gradient in neighbourhoods with access to a large range of this outlet type.

Discussion

The most notable finding of this national study is that there is a clear social pattern in the distribution of food and alcohol outlets in New Zealand, with a higher prevalence in more

socially deprived neighbourhoods. Further, this pattern was consistent for all outlet types: supermarkets, convenience stores, fast food outlets and alcohol outlets. The number of outlets per 10 000 population were at least 2.76 times greater among the most deprived fifth of urban neighbourhoods compared to the least deprived fifth. Using Euclidean buffers around each neighbourhood centroid, we also found that there was a better choice and range of outlets in more deprived urban neighbourhoods and this social gradient in the distribution was consistent for all outlet types. Further, the findings were not sensitive to the size of the buffer used. The results of this research extend the earlier work on food access in New Zealand by demonstrating that the choice and range of food outlets in urban neighbourhoods is socially stratified and that alcohol outlets are spatially patterned in a similar way. The findings provide evidence that food and alcohol outlets tend to co-locate in more deprived New Zealand neighbourhoods.

Our results are consistent with previous New Zealand findings which found that access to the closest supermarket and convenience stores (Pearce *et al.*, 2007b) as well as fast food outlet (Pearce *et al.*, 2007a) was patterned by neighbourhood deprivation in a similar way. For example, the median neighbourhood travel distance to the closest fast food outlet was more than twice as high in the least deprived quintile of neighbourhoods compared to the most deprived quintile (Pearce *et al.*, 2007a). With regards to supermarkets, the findings concur with some international studies, such as work in Glasgow which found that food stores were more likely situated in deprived areas of the city (Cummins & Macintyre, 1999). However, overall the results are not consistent with the prevailing international evidence that has found either no social stratification, or more commonly that 'healthy' food outlets tend to be located in less disadvantaged or low ethnic minority neighbourhoods (Alwitt & Donley, 1997; Chung & Myers, 1999; Morland *et al.*, 2002b; Zenk *et al.*, 2005b). With regards to fast food, our findings generally conform with the international evidence. Research in a range of countries including England, Scotland, Australia and the USA has consistently found that fast food restaurants tend to be preferentially located in low-income neighbourhoods (Reidpath *et al.*, 2002; Block *et al.*, 2004; Cummins *et al.*, 2005b; Macdonald *et al.*, 2007). Similarly, our findings are generally congruent with the few studies examining the social stratification in access to alcohol outlets (Pollack *et al.*, 2005; Moore & Diez Roux, 2006). For example, a study of 82 neighbourhoods in four northern and central Californian cities found that the most deprived neighbourhoods had substantially higher levels of alcohol outlet density than the least deprived neighbourhoods (Morland *et al.*, 2002b).

The explanations for why the location of food and alcohol outlets is socially patterned are likely to include an understanding of the land values and the history of planning and zoning measures in New Zealand, which are likely to have influenced the locational choices made by food and alcohol outlet proprietors. For example, lower rental costs may encourage businesses to locate in more deprived neighbourhoods. Further, there may be greater civic resistance to the aesthetic and other impacts of food and alcohol outlets in more affluent suburbs, directly influencing the location of food outlets. Many researchers have noted that the least disadvantaged neighbourhoods often benefit from the decision-making processes that influence the allocation and distribution of various community resources (Knox, 1982).

A key piece of environmental legislation in New Zealand is the Resource Management Act 1991 (RMA), which represents the statutory framework for planning. Central to the Act's philosophy is sustaining environmental resources for the "reasonably foreseeable

needs of future generations” (Ministry of the Environment, 2006, p. 24). However, the legislation was developed in a climate of a neoliberal transformative discourse in New Zealand society and has been criticised for its heavy emphasis on an ‘environmental bottom line’¹ and the limitations placed upon the capacity of the planning system to influence social and economic concerns (LeHeron & Pawson, 1996). It has been argued that this focus upon environmental bottom lines, rather than wider definitions of sustainability that integrate social equity concerns, has compromised the RMA’s capacity to protect and sustain ecological values in resource development (Perkins & Thorns, 2001). Therefore, concepts of social sustainability are not enshrined within key components of the regulatory framework in New Zealand and may help to explain the socio-spatial distribution of food and alcohol outlets across New Zealand communities.

Our results should also be of interest to policymakers in New Zealand. An improved understanding of the local food environment could have significant implications for health promotion and for the reduction in health inequalities between deprived and non-deprived neighbourhoods (Diez Roux, 2001). Locational access to shops selling ‘healthy’ and ‘unhealthy’ food, as well as alcohol, has been implicated as a key mediator between neighbourhood social deprivation and nutrition (Morland *et al.*, 2002a; Kamphuis *et al.*, 2006) and alcohol-related (Gruenewald *et al.*, 1996) health outcomes of the local residents. However, our findings suggest that, unlike elsewhere, at a national level it is doubtful whether locational accessibility to outlets selling food and alcohol services alone will be a key mediator between deprivation and health in urban areas. Nonetheless, an improved understanding of neighbourhood access to food outlets over time and a direct assessment of the contextual effects of the food and alcohol environment upon health outcomes and inequalities is warranted.

The study’s limitations need to be considered. First, factors other than geographic proximity of fresh food outlets that are not considered in this study such as quality, cost and food knowledge are likely to influence the relationship between consumption patterns, health and socio-economic disadvantage. Similarly for alcohol, factors other than geographic proximity such as social supply and the regulatory environment are among a number of likely alternative determinants of alcohol consumption patterns. Second, the analysis of choice and range of facilities using Euclidean buffers is problematic because, as has previously been noted (Witten *et al.*, 2003; Pearce *et al.*, 2006), in some urban areas nearby roads may not be connected due to the layout of the street network, or because of physical features such as high topography, tidal flats or bodies of water. Future research could usefully utilise more sophisticated GIS measures of neighbourhood accessibility that calculate distance through the road network rather than the Euclidean measurements used in this study. Third, residents may procure food and alcohol from retailers outside of their own neighbourhoods, for example, in the vicinity of their workplace or school. Similarly, residents’ perceptions of the extent and scope of their neighbourhood may differ from the distance-based definitions used in this study. An examination of the daily mobility patterns and food and alcohol retail choices of residents is warranted.

In conclusion, this research contributes to the growing body of research into ‘environmental’ or ‘contextual’ understandings of obesity, nutrition and alcohol consumption. In particular, researchers have considered whether neighbourhood exposure to outlets selling food and alcohol is stratified by socio-economic disadvantage. However, most previous studies have been limited to considering only one type of outlet (e.g. supermarkets) or examining the distribution of provision across a restricted

geographical area (e.g. a single urban area). In this study, we found that supermarkets, convenience stores, fast food and alcohol outlets are disproportionately located in more deprived urban neighbourhoods across New Zealand and that the range of outlets available is more extensive in deprived neighbourhoods. The findings highlight the importance of evaluating the socio-spatial distribution of all components of the 'food environment' prior to developing strategies to reduce nutrition and alcohol-related health inequalities.

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Note

1. The 'environmental bottom line' refers to the predominant focus on precise environmental standards at the expense of wider definitions of sustainability. Consistent with this accountancy metaphor, as long as this bottom line is met then market forces are left to create the 'optimal' use of the resources available (see Perkins & Thorns, 2001, for a wider discussion).

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