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# A national study of the association between neighbourhood access to fast-food outlets and the diet and weight of local residents

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ABSTRACT

Differential locational access to fast-food retailing between neighbourhoods of varying socioeconomic status has been suggested as a contextual explanation for the social distribution of diet-related mortality and morbidity. This New Zealand study examines whether neighbourhood access to fast-food outlets is associated with individual diet-related health outcomes. Travel distances to the closest fast-food outlet (multinational and locally operated) were calculated for all neighbourhoods and appended to a national health survey. Residents in neighbourhoods with the furthest access to a multinational fast-food outlet were more likely to eat the recommended intake of vegetables but also be overweight. There was no association with fruit consumption. Access to locally operated fast-food outlets was not associated with the consumption of the recommended fruit and vegetables or being overweight. Better neighbourhood access to fast-food retailing is unlikely to be a key contextual driver for inequalities in diet-related health outcomes in New Zealand.



## Background

The link between diet and health is well established with poor dietary intake being associated with a higher incidence of a multitude of adverse health outcomes (World Cancer Research Fund/American Institute for Cancer Research, 2007) including many of the leading causes of death such as stroke (Joshipura et al., 1999), heart disease (Kushi et al., 1985) and various types of cancer (Danaei et al., 2005). Further, social variations in diet-related morbidity and mortality are well established with people of lower socioeconomic position and people living in more deprived areas tending to have worse diet-related health outcomes (Davey Smith and Brunner, 1997).

The explanations for the socioeconomic patterns in dietary intake have been related to a number of factors including educational level, employment status, income and cultural differences (Dowler, 2001). However, it has been suggested that there has been an over emphasis on individual-level factors (Egger and Swinburn, 1997), and that individual-based interventions have had limited success. These critiques have led to a renewed interest in the potential neighbourhood or contextual explanations of diet-related health outcomes (Cummins and Macintyre, 2006; Hill and Peters, 1998; Macintyre, 2007). One contextual mechanism that may help to explain inequalities in diet is that fast-food outlets selling less healthy food are disproportionately over represented in low income, high ethnic minority and more socially deprived neighbourhoods. Research in the US (Morland et al., 2002b; Block et al., 2004), England and Scotland (Cummins et al., 2005b; MacDonald et al., 2007; Macintyre et al., 2005) and Australia (Burns and Inglis, 2007; Reidpath et al., 2002) has overwhelmingly demonstrated that less advantaged areas tend to have better locational access to fast-food retailers. Similar findings were noted in New Zealand where, at the national level, neighbourhood median travel distance to both multinational fast-food outlets and locally operated outlets were found to be at least twice as far in the least socially deprived neighborhoods compared to the most deprived neighborhoods (Pearce et al., 2007a).

Although the weight of international evidence demonstrates a greater opportunity to procure fast-food in more deprived neighbourhoods, the role of the local food environment in influencing people's dietary choices and on obesity is unclear. The evidence from the US suggests that, with some exceptions (Wang et al., 2007), worse access to food retailing facilities (supermarkets and convenience stores) has a deleterious impact on diets and obesity (Laraia et al., 2004; Morland et al., 2002a, 2006; Zenk et al., 2005), although outside of the US the findings tend to be more mixed (Cummins et al., 2005a; Wrigley et al., 2002, 2003; Pearce et al., 2008b). The explanations for the inconsistent results between the US and elsewhere are likely to be

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multifaceted, but may include the stronger role that residential neighbourhoods in the US exert on the health of local residents (Cummins and Macintyre, 2006). It is plausible that neighbourhoods in the US may influence individual-level health outcomes to a greater extent than elsewhere due to the higher levels of residential segregation in US cities (Johnston et al., 2007). Increased residential segregation has resulted from the selective migration streams of higher income and white residents into the suburbs of the major metropolitan areas, whilst low income and black residents remaining in the urban centres (Charles, 2003; Massey and Denton, 2003). Residential segregation is likely to exacerbate disparities in neighbourhood exposure to healthy and unhealthy components of the food environment through various pathways including the concentration of targeted consumers in specific geographical localities, differences in land use planning strategies, and neighbourhood variations in residents' abilities to influence political decision making (Kwate, 2008). Few studies have examined the effects of neighbourhood access to fast-food outlets on individual health outcomes. The studies that have taken place have all been in the US, and there is scant evidence for an association between access to fast-food retailing and individual health outcomes (Burdette and Whitaker, 2004; Jeffery et al., 2006; Morland et al., 2002a).

This New Zealand study builds on earlier research that found locational access to fast-food outlets to be stratified by neighbourhood deprivation (Pearce et al., 2007a). Using data from a national health survey, we assess whether neighbourhood access to fast-food outlets is associated with individual diet-related health outcomes, after taking into account individual-level socio-demographic characteristics and potentially confounding neighbourhood features.

## Methods

Data on the addresses of each multinational and locally operated fast-food outlet were collected from all 74 Territorial Authorities (TAs) across New Zealand during 2005. 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. For each outlet, information was requested on the street address as well as its name. The data were verified using the online telephone directory (i.e., Yellow Pages) (Yellow Pages, 2006) and in cases of missing data or incomplete records, the data were supplemented with additional address information. The data were coded into two groups: multinational fast-food outlets (McDonald's, Burger King, Kentucky Fried Chicken, Pizza Hut, Subway, Domino's Pizzas, and Dunkin' Donuts), and the remaining locally operated outlets (e.g. fish and chip shops). A total of 2930 fast-food outlets in New Zealand were registered, of which 474 were multinational outlets. Geographical access to multinational and locally operated fast-food outlets was calculated separately for all 38,350 census meshblocks across New Zealand. On average, meshblocks contain approximately 100 people, and due to their small size, are the closest representations of a 'neighbourhood' in New Zealand. Each neighbourhood was represented by its population-weighted centroid and the travel distance to the nearest multinational and locally operated outlet along the road network was calculated using the network functionality in a Geographical Information System (GIS) (Pearce et al., 2006).

The 2002/03 New Zealand Health Survey (NZHS) is a national survey of the health status of 12,529 adults aged 15+ (target population 2.6 million) posing a range of questions including dietary intake (Ministry of Health, 2004). Respondents were asked two nutrition-related questions on their average daily servings of fruit and vegetables. Fruit included fresh, frozen, canned or stewed fruit but not fruit juice or dried fruit. Vegetables included fresh, frozen or canned vegetables but not vegetable juices. For each respondent, two dichotomous outcome variables were developed: consuming the recommended two servings of fruit per day, and three servings of vegetables. In addition, for each respondent height and weight measurements were taken which enabled the Body Mass Index (BMI) value to be calculated. A dichotomous variable was developed to indicate whether the respondent was overweight or not (the overweight definition was ethnicity-specific: BMI $>25.0$ for European, Asian and other; BMI $>26.0$ for Māori and Pacific peoples (Swinburn, 1998)).

The two neighbourhood measures of fast-food retail access were divided into two categories (above and below the national-level median distance) and appended to each respondent in the survey. For confidentiality reasons, the Ministry of Health as the suppliers of the health survey data, specified the number of variables that could be appended to health survey outcome variables. The 12,529 respondents were distributed across 1178 meshblock neighbourhoods and there were between 1 and 83 respondents per neighbourhood, although in most neighbourhoods the total number of respondents was less than 20.

Two-level logistic regression models with a random intercept were fitted in the multilevel software package MLWin (version 2.0) using second-order penalised quasilikelihood (PQL) estimation methods. Due to multicollinearity with the exposure variables, we limited our analyses to the main (minimum population 30,000) and secondary urban (population 10,000–29,999) areas. Variables were added in four stages. First, we included design variables to account for the sample stratification and oversampling of ethnic minorities. The design variables were: stratum (ethnic composition of the meshblock), deciles of number of respondents in the meshblock, number of adults in the household and ethnicity (Māori, Pacific people, Asian, or Other). Sex and age were also included in all models. Age was divided into four lifecycle groups (15–24, 25–44, 45–64, 65 or older). Second, individual-level socioeconomic variables were added. The socioeconomic variables included educational qualifications (none, school (16 is the minimum school leaving age in New Zealand), post-school), social class (professional/managerial, other non-manual, skilled manual, semi and unskilled manual), benefits receipt (recipient or not of family support, domestic purposes and/or unemployment benefits), employment status (working or not working) and household income ($<$\$25k, \$25–50k, $>$\$50k). For the BMI analysis additional controls were made for the potentially confounding effects of other health-related behaviours (smoking status and physical activity).

Two potential ecological confounders (at the neighbourhood-level) were added in the third and fourth stages: area deprivation measured using the 2001 New Zealand Deprivation Index (NZDep 2001) (Salmond and Crampton, 2002) divided into quintiles and an area type variable (main urban area, secondary urban area) derived from the 5-level 2001 Urban Area Classification (Statistics New Zealand, 2005). All neighbourhood variables were included as categorical variables to satisfy confidentiality requirements. Potential individual socioeconomic and ecological confounders were selected *a priori* for model building. Potential interactions between the main effects, and ethnicity, age, sex individual SES, area deprivation and area type were also examined.

## Results

We found that the consumption of the recommended daily intake of *fruit* was not associated with neighbourhood access to multinational or locally operated fast-food outlets (Table 1) with odds ratios (OR) of 1.05 and 1.02, respectively. All of the 95%