

Are socially disadvantaged neighbourhoods deprived of health-related community resources?

Jamie Pearce,^{1*} Karen Witten,² Rosemary Hiscock¹ and Tony Blakely³

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Background Recent work in a number of countries has identified growing geographical inequalities in health between deprived and non-deprived neighbourhoods. The health gaps observed cannot be entirely explained by differences in the characteristics of individuals living in those neighbourhoods, which has led to a concerted international public health research effort to determine what contextual features of neighbourhoods matter. This article reports on access to potentially health-promoting community resources across all neighbourhoods in New Zealand. Prevailing international opinion is that access to community resources is worse in deprived neighbourhoods.

Methods Geographical Information Systems were used to calculate geographical access to 16 types of community resources (including recreational amenities, and shopping, educational and health facilities) in 38 350 small census areas across the country. The distribution of these access measures by neighbourhood socioeconomic deprivation was determined.

Results For 15 out of 16 measures of community resources, access was clearly better in *more* deprived neighbourhoods. For example, the travel time to large supermarkets was ~80% greater in the least deprived quintile of neighbourhoods compared with the most deprived quintile.

Conclusions These results challenge the widely held, but largely untested, view that areas of high social disadvantage have poorer access to community resources. Poor locational access to community resources among deprived neighbourhoods in New Zealand does not appear to be an explanation of poorer health in these neighbourhoods. If anything, a pro-equity distribution of community resources may be preventing even wider disparities in neighbourhood inequalities in health.

Keywords Health inequality, neighbourhoods, context, community resources, New Zealand

Introduction

Recent studies in a number of countries have firmly established a strong social and geographical gradient in a range of health outcomes including mortality,^{1–4} various types of morbidity such as cancer incidence⁵ and health-related behaviours including

smoking patterns.⁶ Most of these studies have tended to find higher rates of ill health among more socially and materially disadvantaged individuals, and these gaps (in relative terms at least) have widened in rich countries,³ including New Zealand.^{1,2,7} There are also gradients in health across geographic areas. Regional (average population about 200 000) inequalities in New Zealand have been noted for mortality,⁸ cancer incidence⁹ and health-related behaviours such as smoking.⁶ Further, the range of life expectancy in New Zealand between neighbourhoods (average population about 2000) has been estimated at 28.5 years, compared with a range of 5.0 years between regions.¹⁰ When ranking regions within New Zealand by deprivation, regional inequalities in mortality widened during the 1980s and 1990s

¹ GeoHealth Laboratory, Department of Geography, University of Canterbury, New Zealand.

² Centre for Social and Health Outcomes Research and Evaluation, Massey University, New Zealand.

³ Wellington School of Medicine and Health Sciences, University of Otago, New Zealand.

* Corresponding author. GeoHealth Laboratory, Department of Geography, University of Canterbury, Private Bag 4800, Christchurch 8020, New Zealand. E-mail: jamie.pearce@canterbury.ac.nz

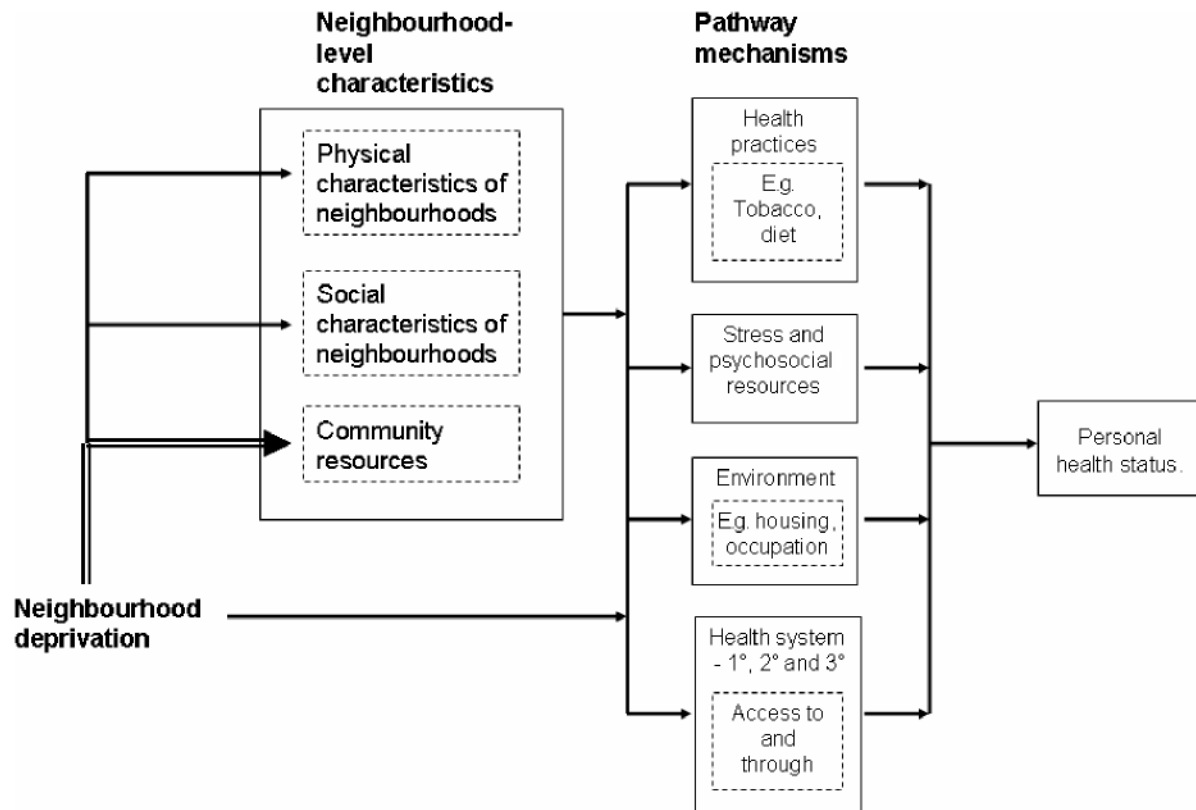


Figure 1 Causal framework of neighbourhood deprivation's association with personal health status, possibly mediated via neighbourhood-level characteristics such as access to community resources. The double-lined arrow is that component of the causal framework tested in this study. Not included in the diagram is the undoubtedly large role of causal pathways between individual-level socioeconomic position (correlated with neighbourhood deprivation) and personal health. Rather, this diagram just considers those possible causal mechanisms arising *per se* from neighbourhood deprivation

by ~50%,¹¹ and health differences between neighbourhoods have been clearly shown to be gradated by a neighbourhood-level measure of deprivation.¹²

Thus, there are inequalities in health across many dimensions: between individuals themselves, between socioeconomic and ethnic groupings of individuals, and between spatial or geographic groupings of individuals. The starting point for this study is the large inequalities in health between neighbourhoods in New Zealand, in particular between neighbourhoods ranked by deprivation.¹² A major explanation for this inequality is the varying socioeconomic position of individuals living in these neighbourhoods. However, contextual properties of neighbourhoods still matter, for a range of reasons: it is not simply a random process whereby individuals of differing socioeconomic position are 'sorted' into different neighbourhoods; individual-level variables (e.g. smoking) are probably in part determined by neighbourhood context, rather than just individual-level or compositional confounders; and, whilst potentially over-controlling for individual-level mechanisms, most multi-level studies suggest that there are neighbourhood-level differences in health that are not just a function of individual-level factors.^{13–15}

But what neighbourhood contextual factors might actually be influencing health? One simple categorization differentiates three domains: neighbourhood physical characteristics, social characteristics and community resource access (Figure 1). There

are plausible arguments for how access to neighbourhood resources could influence health,^{16–18} but not a lot of direct research evidence on which specific resources matter.¹⁹ Among the few studies to examine this issue, it has been noted that better access to leisure and recreational facilities as well as outlets selling healthy and non-healthy food can have a direct influence on diet²⁰ and health behaviours such as physical activity and obesity-related health outcomes.²¹ Further, neighbourhood access to primary health care provision has been linked to the utilization of these services.^{22,23}

Returning to the starting point for this study, it is often assumed that differential access to neighbourhood resources is one explanation for the observed gap in health between deprived and non-deprived neighbourhoods. Referring to Figure 1, the argument would be that neighbourhood deprivation impacts on health status via different levels of access to neighbourhood community resources (the double-line arrow). However, the evidence-base for such a deprivation gradient in service and amenity access is not strong, and in some cases the policy agenda has extended beyond the available evidence.²⁴ This is an important issue if improving geographical access to community resources is advocated as a strategy to reduce health disparities—or more specifically, neighbourhood-level disparities by deprivation. Perhaps the health-related community resource which has received the most attention is geographical access to health-care provision. In particular,

researchers have examined whether people living in the most deprived areas have the worst geographical access to health-care services: a possible contributor to the 'inverse care law'.²⁵ However, the international evidence is mixed as some studies have found that geographical access to primary²⁶ and secondary care²⁷ is worse in deprived areas than in non-deprived areas, whilst other studies have found the opposite result.²⁸ There has also been considerable focus upon whether socially deprived neighbourhoods have poor access to shops selling high-quality and nutritious food, or in other words whether there is a presence of what has become termed a 'food desert'.^{29,30} The strongest evidence for food deserts comes from the USA where it has been suggested that supermarkets are shifting away from poorer inner city areas.^{31,32} However, outside of the US, the evidence for food deserts is mixed.^{24,29,33–35} Research into inequalities in recreational and educational resources is more fragmented. In Scotland, different studies have noted an inequitable distribution in recreational facilities in favour of both high-income¹⁷ and low-income³⁶ neighbourhoods. Similarly, poorer access has been found in deprived areas for some types of pre-school in the UK,³⁷ and to American primary schools in areas where rural poverty is an issue.³⁸

In this study, we test whether community resource access is differentially distributed by neighbourhood deprivation across New Zealand, and therefore whether it is a potential explanatory variable for observed differences in neighbourhood health status. That is, we are testing the presence (or not) of the double arrow in Figure 1. In our earlier work it was noted that there are clear regional variations in geographical access to community resources across New Zealand.³⁹ However, like elsewhere, there is limited research examining whether community resources vary between deprived and non-deprived neighbourhoods.⁴⁰ In this study, we use a Geographical Information Systems (GIS) approach to measure access to 16 domains and sub-domains of health-related community resources across New Zealand. To our knowledge, this is the first study that adopts a GIS approach to consider inequalities in accessibility at a national level and the first to consider such a comprehensive set of health-related community resources.

Data and methods

A GIS approach allows measurement of access to a range of key community resources in small areas across the country using travel time measures that are not constrained by an arbitrary set of administrative boundaries. An index of accessibility was calculated using the distance between each small area census unit and the closest resource along the road network.³⁹ The second stage of the analysis tested whether access to community resources varied between deprived and non-deprived neighbourhoods.

Community resource access data

Access to 16 different types of community resources which are plausibly related to health were calculated for neighbourhoods across New Zealand (Table 1), and grouped into five wider domains [access to health care provision, active recreational

facilities, marae (Maori meeting places), food shopping facilities and educational facilities]. Where possible, data on the location of community resources were obtained at the national level in order to maintain a consistent and directly comparable dataset. However, whilst some datasets (e.g. parks) were readily available in a spatially referenced dataset at a national level, other data (e.g. food outlets) had to be requested from the 74 individual Territorial Authorities (local authorities with some delegated governance) across New Zealand and then the precise location of each record computed from its address using geocoding software. All datasets were the most accurate at time of collection (2004–05) and no data set was older than 2002.

Calculating community resource accessibility

Community resource accessibility was calculated for each sub-domain across New Zealand for all 38 350 census meshblocks, or what we refer to as 'neighbourhoods'. Meshblocks are the smallest unit of dissemination of census data in New Zealand with each area designed to represent ~100 people. However, the population of meshblocks ranges from <10 to >1000 people and there is substantial variation in the land areas of each unit. In this analysis, each meshblock was represented by its population-weighted centroid (the centre of population in the area rather than the geometric centroid) and the travel time taken to each community resource along the road network was calculated using the network functionality in a GIS. In order to represent accessibility more accurately, it is important to use the distance between each meshblock and the location of each community resource through the road network to calculate total travel time rather than the euclidean (or straight line) distance.⁴¹ All segments in the road system were adjusted to account for variations in speed limits, type of road surface, sinuosity and differences in the topography across the network. These modifications to the road network were important because they allowed for realistic estimates of the least-cost (i.e. quickest route) from each population-weighted meshblock centroid to each facility, outputting the result as an origin-to-destination matrix. In all 38 350 meshblocks, the travel time along the road network between each population-weighted meshblock centroid and its closest facility (e.g. the travel time to the nearest school) was calculated for each sub-domain. Full details of the methodology used to calculate accessibility are documented elsewhere.³⁹

Analysis

To consider whether access to each of the 16 sub-domains of community resources varied between areas of differing levels of social deprivation, each meshblock was categorized into a quintile of deprivation using the 2001 New Zealand Deprivation Index (NZDep 2001), an index based on nine socioeconomic variables taken from the 2001 New Zealand census⁴² that has been widely used in a range of health-related studies.^{43,44} For a small number of meshblocks (1.3% of all meshblocks) the NZDep 2001 score was not available, and these meshblocks were excluded from the analysis. Travel times to all community resources had a highly skewed distribution, so non-parametric analysis was necessary. The median travel time to each community resource of the meshblocks in each quintile was

Table 1 Sources of data for domains and sub-domains in the community resource access index

Domains and sub-domains	Source of data	Year collected
1. Recreational amenities		
Parks	Modified from Land Information New Zealand and the Department of Conservation	2004
Sports and leisure	ACC Pool Safe (Water Safety New Zealand)	2005
Beaches	Modified from Land Information New Zealand point dataset	2005
2. Shopping facilities		
Supermarkets	Company websites	2004
Dairy, fruit and vegetables and service stations	Territorial Local Authorities	2004
3. Educational facilities		
Kindy/day care/playcentres	Ministry of Education	2004
Primary schools	Ministry of Education	2002
Intermediate/full primary schools	Ministry of Education	2002
Secondary schools	Ministry of Education	2002
4. Health facilities		
General practitioners	Ministry of Health	2003
Pharmacies	Ministry of Health	2003
Accident and emergency	Ministry of Health	2003
Plunket ^a	White pages/internet	2004
Ambulance	Ministry of Health	2002
Fire stations	Ministry of Health	2002
5. Marae	Takoa directory ^b and internet research	2005

^a Plunket is a government-funded well-child service established in 1907.

^b Takoa is a directory of Māori organizations and resource people published by Tuhi Tuhi Communications, Auckland. Maori are the indigenous people of New Zealand.

calculated and plotted, and ratios for most to least deprived quintiles calculated. To consider whether the differences in accessibility to community resources between the deprivation quintiles were significant, non-parametric Spearman's rank correlations between access quintiles and deprivation quintiles were calculated.

Results

An examination of the relationship between access to the 16 community resources and social deprivation at the national level demonstrates that there is a clear social gradient in access to community resources for meshblocks across New Zealand (Figure 2; Table 2). For all of the community resource sub-domains, except beaches, median travel times were further in the least deprived quintile compared with the most deprived quintile. With the exception of beaches, the ratio of median travel times in the most deprived compared with least deprived quintiles of neighbourhoods ranged from 0.47 (food shops) to 0.78 (fire stations). Of the health sub-domains, the median travel time to a GP in a deprived neighbourhood was 56% of that in the least deprived neighbourhoods. Likewise, median travel time to a pharmacy in deprived neighbourhoods was 57% of that in non-deprived neighbourhoods. With the

exception of beaches, there is a strong gradated negative relationship between access and deprivation for all types of community resources (Spearman's rank correlations, and associated *P*-values in Table 2). Among the sub-domains, the rank correlation was particularly strong for food shops, supermarkets, primary schools and intermediate/full primary schools.

Discussion

This research has determined whether socially disadvantaged neighbourhoods across New Zealand are also deprived of access to a range of key health-related community resources, relative to less socially disadvantaged neighbourhoods. We have adopted a GIS approach to measure geographical access to 16 different types of community resources in small areas across the country, and used this index to examine whether there is a social gradient in accessibility. A negative relationship between deprivation and travel time access was evident to most community resources—access is better in more deprived neighbourhoods of the country.

This study has limitations. First, our examination of the relationship between community resource accessibility and

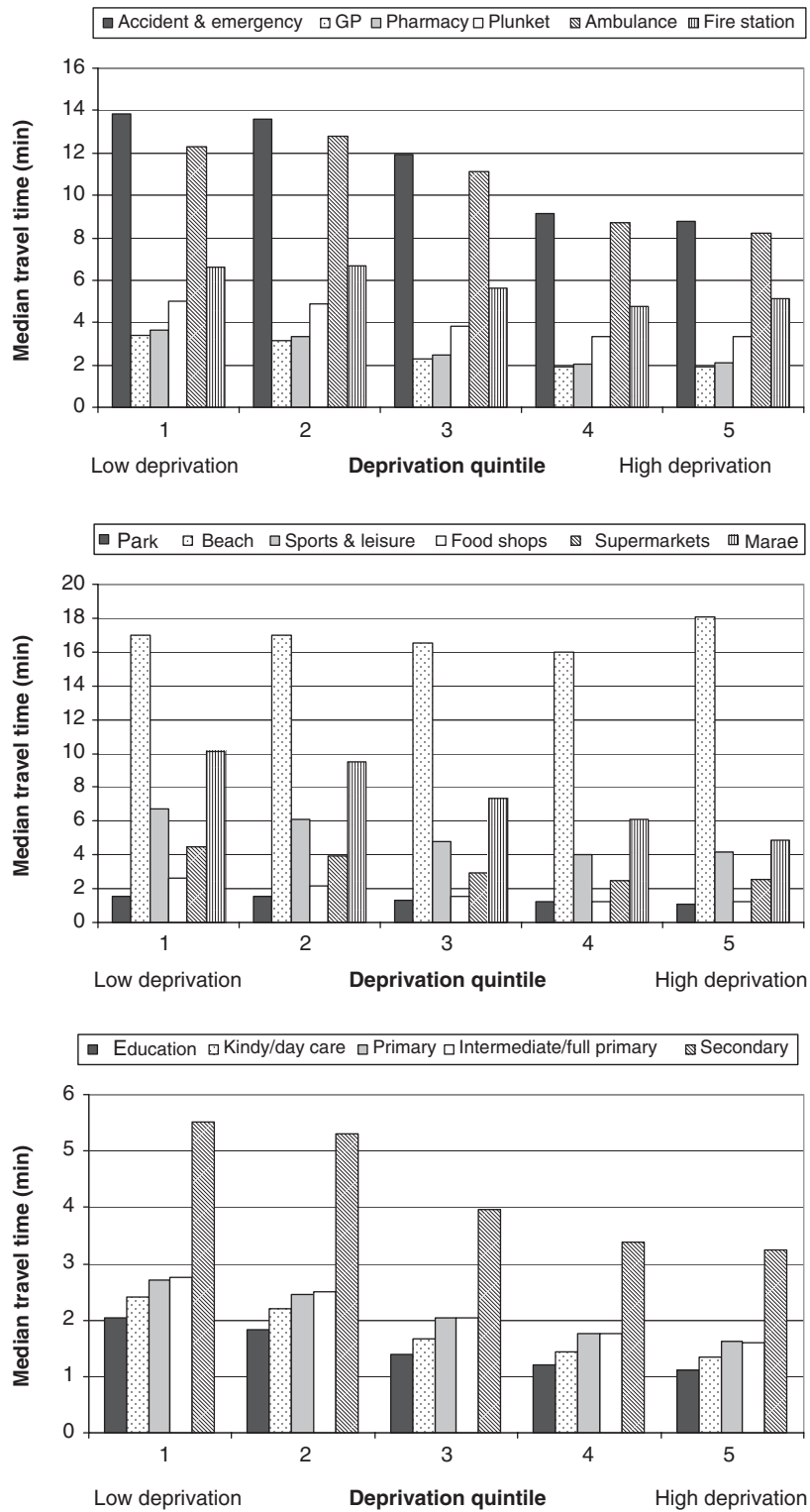


Figure 2 Median travel time to 16 sub-domains of community resources in deprivation quintiles across New Zealand

social deprivation has focused only on locational accessibility. As has been suggested elsewhere,⁴⁵ there are, of course, other important barriers to utilizing community resources beyond residential proximity including costs such as transport and entry fees. In New Zealand, there has been a cost associated

with visiting a GP,⁴⁶ a key barrier to utilization of health care, particularly in socially deprived communities,⁴⁷ although there has been a means-tested system of subsidies, and this barrier has recently been addressed by a new primary health care strategy.⁴⁸ Second, the index of accessibility does not

Table 2 Relationship between neighbourhood deprivation and community resource accessibility across all meshblocks in New Zealand

Domains and sub-domains of community resource access	Median travel time (min)	(95% CI of median)	Median travel time (min) for NZDep 2001 quintiles					Ratio Q5:Q1	Spearman's rank order correlation	
			Q1 (least deprived)	Q2	Q3	Q4	Q5 (most deprived)		ρ	<i>P</i>
Health	2.00	(1.98–2.03)	2.98	2.58	1.91	1.60	1.60	0.54	–0.25	<0.001
Accident and emergency	11.41	(11.25–11.53)	13.86	13.61	11.93	9.17	8.76	0.63	–0.16	<0.001
GP	2.39	(2.36–2.41)	3.42	3.12	2.26	1.93	1.90	0.56	–0.24	<0.001
Pharmacy	2.54	(2.52–2.57)	3.63	3.36	2.45	2.04	2.08	0.57	–0.24	<0.001
Plunket	4.04	(4.00–4.09)	5.02	4.86	3.84	3.32	3.32	0.66	–0.15	<0.001
Ambulance station	10.66	(10.53–10.80)	12.27	12.79	11.13	8.72	8.20	0.67	–0.11	<0.001
Fire station	5.73	(5.67–5.78)	6.62	6.65	5.64	4.78	5.15	0.78	–0.13	<0.001
Diet	1.54	(1.52–1.55)	2.48	2.03	1.48	1.21	1.16	0.47	–0.32	<0.001
Food shops	1.61	(1.59–1.62)	2.59	2.14	1.55	1.26	1.21	0.47	–0.31	<0.001
Supermarkets	3.17	(3.13–3.20)	4.47	3.96	2.94	2.49	2.51	0.56	–0.26	<0.001
Recreation	1.29	(1.27–1.30)	1.53	1.53	1.28	1.17	1.07	0.70	–0.19	<0.001
Park	1.33	(1.32–1.34)	1.56	1.57	1.34	1.22	1.11	0.71	–0.18	<0.001
Beach	16.89	(16.72–17.06)	16.97	16.97	16.56	15.99	18.07	1.06	0.01	0.291
Sports and leisure	5.07	(5.01–5.12)	6.69	6.11	4.79	3.98	4.15	0.62	–0.22	<0.001
Marae	7.36	(7.27–7.43)	10.12	9.48	7.32	6.12	4.86	0.48	–0.30	<0.001
Education	1.43	(1.42–1.44)	2.04	1.82	1.40	1.20	1.12	0.55	–0.28	<0.001
Kindy/day care	1.72	(1.70–1.74)	2.40	2.21	1.67	1.43	1.35	0.56	–0.25	<0.001
Primary	2.04	(2.03–2.06)	2.72	2.46	2.05	1.77	1.62	0.60	–0.28	<0.001
Intermediate/full primary	2.05	(2.03–2.06)	2.76	2.50	2.05	1.75	1.61	0.58	–0.28	<0.001
Secondary	4.08	(4.04–4.12)	5.52	5.30	3.97	3.38	3.25	0.59	–0.25	<0.001

incorporate a measure of the quality of the community resources, and quality may vary systematically between deprived and non-deprived neighbourhoods. Further, perceived safety of the neighbourhood through which people pass to reach a service or amenity, particularly if they are walking, may also impact on its use.⁴⁹ For example, locational access to parks may be health-promoting in some neighbourhoods, yet in other neighbourhoods it may be associated with fear and violence. There is some evidence that perceptions of neighbourhood disorder and safety are associated with the socioeconomic characteristics of an area.⁵⁰ Thirdly, the index is based on travel times by car but access to cars themselves is patterned by neighbourhood socioeconomic characteristics. A fourth limitation of the work is that the extent to which a social gradient in population density may provide a partial explanation for the findings has not been established.

Despite these limitations, the consistency and strength of these findings are noteworthy given the mixed results in the international literature. Previous studies outside New Zealand have found varied evidence for a social gradient in access to health care provision, recreational resources, food shopping facilities and educational facilities. However, the findings of this study support earlier work in two New Zealand cities which found that access to resources was better in more deprived areas of these cities.^{40,41} The inconsistent relationship between community resource access and socioeconomic measures between countries and regions suggests that the results may

be context-specific, reflecting unique social and historical factors, for example, the dominant transport modality at the time neighbourhood infrastructure was developed. The results of this research should encourage researchers in other countries to examine the distribution of community resources in their own countries and avoid making unsubstantiated assumptions about the social distribution of access to neighbourhood resources.²⁴

The importance of this work lies in understanding the way neighbourhood context and infrastructure may be modified to improve population health and reduce health inequalities.³¹ These results suggest that poor locational access to community resources in deprived neighbourhoods in New Zealand is unlikely to be an explanation for the relatively poor health outcomes in these neighbourhoods. It is, however, possible that neighbourhood inequalities in health by deprivation may be tempered by the pro-equity distribution of community resources. If similar negative findings are established in other countries, then attention must be shifted to other potential explanations for neighbourhood-level inequalities in health.

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Commentary: Investigating neighbourhood effects on health—avoiding the ‘Local Trap’

Steven Cummins

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Introduction

In recent years, the challenge in understanding neighbourhood effects in epidemiology has moved on from simply describing that ‘place’ matters independently of the ‘individual’ to identifying the plausible causal pathways by which neighbourhood social and material environment may affect health. Much of this more recent work has relied on an underlying conceptual model described by Macintyre¹ as ‘deprivation–amplification’—a situation where residents of deprived neighbourhoods have poorer local access to health-promoting resources than their counterparts in more affluent areas. This theoretical model forms the basis of Pearce and colleagues’² interesting national study of spatial accessibility to health-promoting neighbourhood resources in New Zealand. In contradiction to the established ‘deprivation–amplification’ hypothesis, their study suggests that access (as measured by network travel times) to a wide variety of health-promoting resources is greater in deprived compared with more affluent neighbourhoods.

Though this is the first national study to demonstrate such an association, the findings are not necessarily new. Similar counter-intuitive findings have also been reported for the plausible contextual predictors of poor diet³ and physical activity.^{4,5} If we look further back, The Alameda County Study provides evidence that the presence of plausible

health-promoting neighbourhood commercial resources (such as grocery stores) is positively associated with an increased risk of death.⁶ It has been suggested that these ‘null’ findings may be because the spatial distribution of environmental ‘goods’ and ‘bads’ by area deprivation varies by the type of resource investigated, the time period under investigation and the nation in which the study is conducted, with the last point particularly salient as the vast majority of positive findings originate in the US.^{1,7} However, Pearce and colleagues suggest that the consistency and strength of their results indicate that poor locational access to community resources in deprived neighbourhoods in New Zealand is unlikely to be an explanation for the relatively poor health outcomes found there. The authors quite rightly acknowledge the limitations of their study and cite possible systematic differences in resource quality, the assumption of motorized travel and the mediating effect of the social environment as possible explanations for their results. One further, and often neglected, question remains—how can individual exposure to ‘context’ itself be better conceptualized?

Falling into the ‘Local Trap’

The ‘deprivation–amplification’ hypothesis is underpinned by an assumption that only the physically ‘local’ matters in terms of the health-damaging and health-promoting features of the social and physical environment. This idea that the ‘local’ scale (i.e. small areas or neighbourhoods) is the ‘only’ meaningful unit of interest in research and the development of policy has

Department of Geography, Queen Mary, University of London, Mile End Road, London E1 4NS, UK. E-mail: s.c.j.cummins@qmul.ac.uk