

Does It Matter What You Measure? Neighbourhood Effects in a Canadian Setting

Ce que vous mesurez a-t-il de l'importance?
L'effet de quartier dans une région du Canada



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Abstract

Data from 8,032 Manitoba respondents to the 1996/97 Canadian National Population Health Survey were linked to the 1996 census to study whether measures of morbidity, both self-reported and objectively determined, were affected by neighbourhood context. Once age, gender, smoking status, diabetes, body mass index and individual income were added to individual and multi-level regression models, effects of various neighbourhood characteristics were attenuated and significant in relatively few cases. Caution is definitely called for in generalizing from studies based on one or two dependent variables. Weak relationships are likely to lead to contradictory findings with respect to the importance of neighbourhood effects.

Résumé

Nous avons fait le lien entre les données provenant de 8 032 répondants manitobains à l'Enquête nationale sur la santé de la population canadienne 1996/1997 et le recensement de 1996, afin de voir si les mesures de morbidité (tant autodéclarées qu'objectivement déterminées) étaient influencées par le contexte du quartier. Après avoir tenu compte de l'âge, du sexe, du tabagisme, du diabète, de l'indice de masse corporelle et du revenu individuel dans les modèles de régression multiniveau et individuelle, les effets de plusieurs caractéristiques associées au quartier se trouvent atténués et ne s'avèrent significatifs que dans relativement peu de cas. Il faut réellement être prudent dans les généralisations provenant d'études qui se fondent sur une ou deux variables indépendantes. La faiblesse des relations établies peut mener à des conclusions contradictoires quant à l'importance de l'effet de quartier.

THE RELATIONSHIP BETWEEN HIGHER INDIVIDUAL SOCIO-ECONOMIC status (SES) and better health has been documented in many contexts (Smith et al. 1990). A number of studies using different methodologies have reported a direct, if modest, influence of neighbourhood factors on various health outcomes, even after taking individual characteristics into account. In many contexts, neighbourhood characteristics have been found to directly affect mortality (Kawachi and Berkman 2003a; Jones et al. 2000; Yen and Kaplan 1999; van Lenthe et al. 2005; Bosma et al. 2001; Jaffe et al. 2005). Are various measures of health affected by neighbourhood context in a Canadian province where no direct effect on mortality was found (Roos et al. 2004)? Because morbidity measures and self-reported health are known predictors of mortality, these health outcomes might well not be affected by neighbourhood characteristics (Idler and Benyamini 1997). However, other Canadian studies have found neighbourhood effects; such effects appear stronger both for

morbidity measures (compared to mortality) and for subjective measures (compared to objective) (Malmstrom et al. 2001; Pickett and Pearl 2001; Boyle et al. 2004; Martikainen et al. 2004; Hou and Myles 2005; Simpson et al. 2005; Robert 1998; Veenstra et al. 2005).

Both individuals and neighbourhoods are commonly classified on a continuum of socio-economic status; variables typically differ among studies, limited by the availability of data. Project locales, research designs, sampling methodologies and specific health outcomes examined also range widely. These variations have contributed to controversy as to whether neighbourhoods directly affect health, making it difficult to predict whether a lack of effect on mortality will correspond to a similar lack of effect on morbidity measures.

This study concentrates on a single province, restricting differences in political and social contexts while providing considerable variation in income, urban–rural status and so on (Duncan and Raudenbush 2001). Both the sampling methodology and individual neighbourhood characterization are identical to those in our previous study of mortality (Roos et al. 2004).

This paper examines how health outcomes other than mortality, including both self-reported and objectively determined measures of morbidity, are affected by neighbourhood characteristics. This research works towards understanding the pathways by which neighbourhood characteristics affect morbidity and mortality. Such studies are rare in the published literature.

Methods and Materials

Sampling and linkage

Our method of sampling and linkage has been described in detail elsewhere (Roos et al. 2004). The sample included 8,032 Manitoba respondents aged 18 to 75 in the 1996/97 Canadian National Population Health Survey (NPHS); these respondents were linked to the Population Health Research Data Repository, housed at the Manitoba Centre for Health Policy. The repository linkage provided information on place of residence (census enumeration area) and health outcomes. A total of 1,105 census enumeration areas were included (the smallest area for which census data are available), because small jurisdictional areas generally show stronger place effects than larger areas (Boyle and Willms 1999; Roos and Walld 2007). Such a design with many small groups appears satisfactory for the modelling carried out here (Raudenbush 2007).

Individual characteristics

Individual variables from the 1996/97 Canadian National Population Health Survey included age, gender, smoking status, diabetes, body mass index (BMI), household

income and education. Where missing data for a variable were less than 1%, those individuals were eliminated from analyses using that variable. Larger amounts of missing data were recorded for household income (13%) and BMI (22%, because NPHS provided this information only for those aged 20–64). Separate “missing BMI” and “missing household income” categories accounted for non-responders when these characteristics were examined.

Utilization of a methodology consistent with earlier studies facilitates meaningful comparisons. Accordingly, the Nova Scotia cutting points, originally used in our earlier study of mortality, were applied in this work (Veugelers et al. 2001; Roos et al. 2004). Respondents to the household income question were grouped according to annual gross household income: (a) less than \$20,000, (b) from \$20,000 to less than \$40,000 and (c) more than or equal to \$40,000 (Canadian dollars used throughout). For comparability, this paper emphasizes the lower half of the SES distribution; accordingly, the terms “rich” and “poor” are used in a relative context. Education was categorized on the basis of the highest level of schooling completed: (a) less than high school, (b) high school or vocational school and (c) college or university. To allow risk adjustment both for persons with low BMI (<20) and for obese persons (those with a BMI ≥ 27), participants were placed into three groups (Veugelers et al. 2001). Descriptive statistics can be found in Table 2 later in this paper.

Neighbourhood characteristics

As in previous studies, mean household income, mean dwelling value, percentage of less than grade 9 education, unemployment rate and percentage of single mothers were available at the enumeration area level from the 1996 Canada Census. These neighbourhood variables had face validity as measures of socio-economic status, were relatively easy to construct from census data and have been suitable for comparative work (Roos et al. 2004). Similar contextual characteristics have been used in other small-area studies (Kawachi and Berkman 2003b). Neighbourhood household income was grouped according to mean annual gross household income: (a) less than \$30,000, (b) from \$30,000 to less than \$40,000 and (c) more than or equal to \$40,000. Mean dwelling value was categorized as less than \$60,000, from \$60,000 to less than \$80,000, and more than or equal to \$80,000. The categories for unemployment rate were less than 10%, 10% to less than 15%, and more than or equal to 15%. Neighbourhoods were also split into those having 15% or more of their residents with an education of less than grade 9 and those having 10% or more of the families headed by single mothers. The socio-economic factor index (SEFI), built from principal components analysis with 23 socio-demographic variables serving as the initial base, was also used to characterize the neighbourhood environment (Roos et al. 2004; Martens et al. 2002). Consistent with earlier cross-provincial work, SEFI was split on its mean,

with above-average values indicating a more disadvantaged area (Veugelers et al. 2001; Roos et al. 2004). Table 3 later in this paper provides descriptive statistics of neighbourhood characteristics. Considering the contextual covariates as tertiles and as (logit transformed) continuous variables did not markedly affect the observed associations.

Health outcomes

Using both interview and administrative data provides a multi-method perspective (Roos et al. 2004). Three measures based on the NPHS interviews represent different aspects of health: self-reported health, health utility and psychological distress. Self-reported health has been noted as the most frequent measure used in studying individual and neighbourhood effects on health outcomes (Riva et al. 2007). A morbidity measure was also created using “the Adjusted Clinical Group (ACG) System, a diagnosis-based, case-mix methodology that describes or predicts a population’s past or future healthcare use and costs” (Baldwin et al. 2006). With mortality dichotomous and relatively infrequent, the outcomes based on interview data were dichotomized for comparative purposes. Responses of poor or fair to the survey question “In general, how would you say your health is?” were considered “low self-reported health.” Answers of good, very good or excellent were included in the reference group. Although the category names sometimes differ, this split follows other research using “less than good health” as the cut-off (Stafford et al. 2005; Cummins et al. 2005).

The Health Utility Index (HUI) – Mark III is a multi-attribute health utility function that takes into account an individual’s vision, hearing, speech, mobility, dexterity, cognition and emotion, as well as pain and discomfort (Drummond et al. 1997; Statistics Canada 1997). Variation in HUI scores reflects differences in health states weighted by a fixed set of utilities. The HUI is summarized into a value between 0 and 1. Scores below 0.90 were considered “low health utility” as “an individual who is near-sighted, yet fully healthy on the other seven attributes, receives a score of 0.95” (Drummond et al. 1997; Statistics Canada 1997). Psychological distress is measured by a six-item symptom checklist that yields a score of 0 to 24 (Statistics Canada 1997). Psychological distress is considered to be present if the NPHS distress score had a value over 5 (a strong predictor of depression) (Patten 2002; Stephens et al. 1999).

The Adjusted Clinical Group (ACG) case-mix adjustment system produces Aggregated Diagnosis Groups (ADGs) that characterize the morbidity of an individual based on hospital discharge abstracts and physician claims (Kozyrskyj et al. 2005). The greater number of ADGs (in the year prior to the interview), the greater the burden of morbidity. This widely used morbidity measure (treated as ordinal) has been validated in Manitoba (Kozyrskyj et al. 2005; Reid et al. 2001, 2002) and is one of several claims-based morbidity measures similarly correlated with mortality (Baldwin et al. 2006).

There were no missing data for mortality, self-reported health or number of

ADGs; missing data for health utility (0.27%) and psychological distress (2.5%) were limited. Individuals with missing health outcome data were eliminated from analyses including the specific outcome. Frequencies of the various health outcomes were determined (Table 1); mortality was included in this table for comparative purposes.

TABLE 1. Frequency of health outcomes among survey participants in Manitoba (N=8,032)

Health outcome	n	Percentage
Mortality	269	3.35
Low self-reported health	782	9.74
Low health utility	2,216	27.59
Psychological distress	1,018	12.67
Number of ADGs ^a		
0	1,476	18.38
1	1,541	19.19
2	1,421	17.69
3	1,161	14.45
4	838	10.43
5	593	7.38
6	412	5.13
7+	590	7.35

^a The larger number of ADGs are condensed only for the purposes of this table; in analyses, "7 and over" were not grouped. The number of ADGs ranged from 0 to 17.

Statistical approaches

The direct influence of individual and contextual characteristics on the health measures was calculated using logistic regressions for the binary health outcomes (low self-reported health, low health utility, psychological distress) and Poisson regression for the ordinal "number of ADGs." Hierarchical modelling was employed when examining the effects of contextual characteristics. Model 1 adjusted for only age and gender to quantify the associations of both individual and contextual characteristics on the various health outcomes (Tables 2 and 3). Adjustments for smoking status, diabetic status and BMI were run, although such adjustments may "overcontrol" because of these variables' association with overall health (Macintyre and Ellaway 2003). Finally, without controlling for individual-level SES, "neighbourhood level variables may act partially or

entirely as proxies for individual attributes and a partition of the contribution of each to the chosen health outcome is impossible" (Pickett and Pearl 2001) (Tables 3 and 4).

Odds ratios (from the logistic regressions) and risk ratios (from the Poisson regressions) for individual characteristics were calculated with SAS v. 8.2; the hierarchical modelling program HLM2 v. 5.00 for Unix was used for analyses including neighbourhood characteristics. Details on power calculations are available from the senior author.

Results

Health outcomes

Table 1 provides the frequencies of the various health outcomes among the 8,032 survey participants. Although not presented here, modest Spearman correlations among the various outcomes were found; this is expected, considering that all but one of the outcomes is binary. Mortality showed the smallest associations with the other measures, with low self-reported health showing the strongest relationship with mortality. The highest correlations for the ordinal measure based on administrative data, the number of ADGs, were with low self-reported health (0.209) and low health utility (0.190).

The sample was almost equally distributed between those aged 18–34 and 35–49 ($n=2,577$ and $2,486$, respectively). There were 1,823 respondents between 50 and 64 and 1,146 between 65 and 74. Females outnumbered males 4,255 to 3,777.

Low self-reported health, low health utility and the number of ADGs showed an expected progression with age. For example, low self-reported health increased from 4.1% (18- to 34-year-olds) to 19.5% (65- to 74-year-olds) with increasing age. On the other hand, psychological distress was more likely among the young, decreasing from 14.4% in 18- to 34-year-olds to 8.2% in those from 65 to 74.

Individual characteristics

Table 2 (see <http://www.longwoods.com/content/21883>) highlights individual characteristics and appropriate odds ratios (ORs) or risk ratios (RRs) for the various health outcomes, adjusted for age and gender. In the same population the age- and gender-adjusted mortality risk was significantly greater among smokers and diabetics (Roos et al. 2004). The other health outcomes all showed similar results, except that smokers did not have a significantly greater age- and gender-adjusted risk of having a higher number of ADGs. Both a BMI of less than 20 and one equal to or more than 27 were associated with low self-reported health, low health utility and more ADGs. BMI was not significantly associated with psychological distress or mortality (Roos et al. 2004). Household income and level of education significantly affected all of the health outcomes when age and gender were controlled for. Because relationships were

only minimally attenuated by controlling for smoking status, BMI and diabetic status, these results were not included in Table 2. Education did not significantly affect mortality when these additional covariates were included in the model (Roos et al. 2004). All health outcomes showed a gradient across income and educational groups, except for the number of ADGs where both the medium- and high-income groups had very similar risk ratios. Missing data were treated as separate categories and were removed from the models (Table 2) to deal with potential biases (Greenland and Finkle 1995); the results did not vary significantly.

Neighbourhood characteristics

Our previous analysis found no significant direct effect of neighbourhood-level characteristics on mortality, regardless of the variables adjusted for (Veugelers et al. 2001; Roos et al. 2004). However, neighbourhood household income, education, unemployment rate, proportion of families with single mothers and the SEFI had a significant age- and gender-adjusted direct effect on self-reported health (Table 3). The majority of these effects persisted after adjustment for proximate health concerns, except for the 10% to $\leq 15\%$ unemployment rate range (compared to $< 10\%$ reference) and SEFI (model 2 in Table 4). With individual household income added to the model, only neighbourhoods with an average household income between \$30,000 and \$40,000 and neighbourhoods with an unemployment rate equal to or greater than 15% were significantly associated with low self-reported health. Higher levels of neighbourhood unemployment were associated with larger odds ratios for low self-reported health. The effects of neighbourhood household income on self-reported health were suggestive across the models but significant for only one category when individual household income was included.

After we adjusted for age and gender, high neighbourhood household income, high neighbourhood unemployment, medium neighbourhood dwelling value and a neighbourhood proportion of families with single mothers over 10% were significantly associated with higher odds of low health utility (Table 3). The effects of high neighbourhood unemployment and high neighbourhood household income disappeared with adjustment for other proximate health concerns. Upon adjustment for individual income, the proportion of families with single mothers no longer significantly affected health utility. Neighbourhood dwelling values in the medium range (\$60,000 to $\leq \$80,000$) continued to have a significant direct effect on low health utility even after the inclusion of individual income (Table 4).

High neighbourhood unemployment and SEFI showed a significant age- and gender-adjusted relationship with psychological distress. After including additional lifestyle factors (model 2) and individual income (model 3), no significant direct effects of neighbourhood-level characteristics on psychological distress were found (Table 4). High neighbourhood unemployment and the proportion of single mothers had signif-

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TABLE 3. Effects of neighbourhood characteristics on various health outcomes adjusted for age and gender (model 1)

	Low self-reported health			Low health utility	
	Total N	n	Model 1	n	Model 1
Neighbourhood household income ^b					
<\$30,000	1,134	156	1.0	349	1.0
\$30,000–<\$40,000	2,863	270	0.67 (0.52, 0.86)** ^c	835	0.97 (0.82, 1.15)
≥\$40,000	4,035	356	0.67 (0.53, 0.85)**	1,032	0.83 (0.70, 0.98)*
Neighbourhood dwelling value±					
<\$60,000	2,300	246	1.0	636	1.0
\$60,000–<\$80,000	2,366	232	0.88 (0.72, 1.09)	716	1.18 (1.02, 1.36)*
≥\$80,000	3,366	304	0.91 (0.75, 1.11)	864	0.96 (0.84, 1.10)
Neighbourhood education of less than grade 9 ≥15%	3,393	378	1.20 (1.02, 1.41)*	984	1.06 (0.95, 1.18)
Neighbourhood unemployment rate (%)					
<10	6,547	604	1.0	1,775	1.0
10–<15	1,017	110	1.27 (1.01, 1.60)*	291	1.16 (0.98, 1.36)
≥15	468	68	1.97 (1.47, 2.63)***	150	1.38 (1.04, 1.82)*
Neighbourhood proportion of families with single mother >10%	3,081	337	1.29 (1.10, 1.52)**	900	1.20 (1.08, 1.34)**
Neighbourhood Socio-Economic Factor Index > mean	3,466	374	1.19 (1.01, 1.40)*	985	1.06 (0.95, 1.19)
		Psychological distress		Number of ADGs	
	Total N	n	Model 1		Model 1
Neighbourhood household income ^b					
<\$30,000	1,134	153	1.0		1.0
\$30,000–<\$40,000	2,863	367	0.92 (0.74, 1.14)		0.93 (0.87, 1.00)
≥\$40,000	4,035	498	0.84 (0.68, 1.03)		0.96 (0.90, 1.02)
Neighbourhood dwelling value±					
<\$60,000	2,300	296	1.0		1.0
\$60,000–<\$80,000	2,366	312	1.03 (0.86, 1.22)		0.99 (0.94, 1.05)
≥\$80,000	3,366	410	0.89 (0.76, 1.04)		1.01 (0.96, 1.06)

TABLE 3. Continued

Neighbourhood education of less than grade 9 $\geq$ 15%	3,393	430	1.04 (0.91, 1.19)		0.98 (0.93, 1.02)
Neighbourhood unemployment rate (%)					
<10	6,547	816	1.0		1.0
10–<15	1,017	129	0.99 (0.79, 1.25)		1.07 (1.00, 1.14)
$\geq$ 15	468	73	1.29 (1.00, 1.67)*		1.14 (1.03, 1.25)*
Neighbourhood proportion of families with single mother > 10%	3,081	422	1.15 (1.00, 1.31)		1.07 (1.02, 1.12)**
Neighbourhood Socio-Economic Factor Index > mean	3,466	465	1.15 (1.00, 1.32)*		1.04 (0.99, 1.08)

^a Effect presented in adjusted odds ratios (confidence intervals); except for Number of ADGs where it is adjusted risk ratio (confidence intervals). The odds ratios and risk ratios were calculated with multi-level logistic and Poisson regression, respectively.

^b Values in Canadian dollars. In the 1990s, one Canadian dollar approximated an average value of \$0.70 in US dollars.

^c *p value<0.05, **p value<0.01, ***p value<0.001.

icant direct, although modest, effects on the number of ADGs even with age, gender, smoking status, BMI and diabetic status controlled for. These relationships remained significant, but slightly attenuated, with the inclusion of individual income (Table 4).

Discussion

Once individual socio-economic status was accounted for, the models that included both individual and neighbourhood household income showed negligible neighbourhood effects. Unlike research examining mortality in the same population, when only age, sex and lifestyle factors were adjusted for, neighbourhood characteristics showed direct correlations with low self-reported health, low health utility and the number of ADGs morbidity measure (Table 4) (Roos et al. 2004). Neighbourhood socio-economic characteristics appear to act as a proxy for individual income to a greater extent when examining morbidity than mortality. The general lack of association between neighbourhood characteristics and psychological distress accords with other evidence that common mental disorders are not affected by small-area variations (Weich 2005).

A key strength of this research is the use of a consistent methodology, the same data sources and similar context as previous Canadian studies (Veugelers et al. 2001; Roos et al. 2004). The use of both objective and subjective measures of morbidity in conjunction with hierarchical modelling are additional strengths. The dichotomization of health outcomes addresses concerns that subjective health measures (particularly at the extremes) may not be consistent across socio-economic and cultural groups (Evans 2007). Although examined morbidity measures can vary by access to health services,

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TABLE 4. Effects of neighbourhood characteristics on various health outcomes adjusted for age and gender, with diabetes, BMI and smoking status added (model 2), and with individual income added (model 3)

		Low self-reported health		Low health utility		
	Total N	Model 2	Model 3	n	Model 2	Model 3
Neighbourhood household income ^b						
<\$30,000	1,134	1.0	1.0	349	1.0	1.0
\$30,000–<\$40,000	2,863	0.72 (0.57, 0.93)*	0.78 (0.61, 1.00)*	835	1.00 (0.84, 1.18)	1.06 (0.89, 1.25)
≥\$40,000	4,035	0.72 (0.57, 0.91)**	0.84 (0.66, 1.07)	1,032	0.86 (0.73, 1.02)	0.97 (0.82, 1.15)
Neighbourhood dwelling value±						
<\$60,000	2,300	1.0	1.0	636	1.0	1.0
\$60,000–<\$80,000	2,366	0.88 (0.72, 1.09)	0.91 (0.74, 1.12)	716	1.18 (1.02, 1.35)*	1.20 (1.04, 1.39)*
≥\$80,000	3,366	0.93 (0.77, 1.13)	1.02 (0.84, 1.24)	864	0.97 (0.85, 1.12)	1.04 (0.91, 1.20)
Neighbourhood education of less than grade 9 ≥15%	3,393	1.19 (1.01, 1.39)*	1.09 (0.93, 1.28)	984	1.05 (0.94, 1.17)	0.98 (0.88, 1.10)
Neighbourhood unemployment rate (%)						
<10	6,547	1.0	1.0	1,775	1.0	1.0
10–<15	1,017	1.20 (0.96, 1.50)	1.16 (0.93, 1.45)	291	1.12 (0.95, 1.31)	1.08 (0.92, 1.27)
≥15	468	1.80 (1.35, 2.39)***	1.58 (1.19, 2.10)**	150	1.30 (0.99, 1.72)	1.18 (0.89, 1.56)
Neighbourhood proportion of families with single mother >10%	3,081	1.23 (1.04, 1.44)*	1.16 (0.99, 1.36)	900	1.16 (1.04, 1.30)**	1.11 (0.99, 1.24)
Neighbourhood Socio-economic Factor Index > mean	3,466	1.13 (0.97, 1.33)	1.05 (0.89, 1.23)	985	1.03 (0.92, 1.15)	0.96 (0.86, 1.07)
		Psychological distress			Number of ADGs	
	Total N	Model 2	Model 3		Model 2	Model 3
Neighbourhood household income ^b						
<\$30,000	1,134	1.0	1.0		1.0	1.0

TABLE 4. Continued

\$30,000–<\$40,000	2,863	0.94 (0.75, 1.16)	1.00 (0.80, 1.24)		0.95 (0.88, 1.01)	0.96 (0.90, 1.03)
≥\$40,000	4,035	0.86 (0.69, 1.06)	0.96 (0.78, 1.19)		0.98 (0.91, 1.04)	1.00 (0.93, 1.07)
Neighbourhood dwelling value ±						
<\$60,000	2,300	1.0	1.0		1.0	1.0
\$60,000–<\$80,000	2,366	1.02 (0.86, 1.22)	1.05 (0.88, 1.25)		1.00 (0.94, 1.05)	1.00 (0.95, 1.06)
≥\$80,000	3,366	0.90 (0.77, 1.06)	0.96 (0.81, 1.12)		1.02 (0.97, 1.07)	1.03 (0.98, 1.08)
Neighbourhood education of less than grade 9 ≥15%	3,393	1.04 (0.91, 1.20)	0.98 (0.86, 1.13)		0.97 (0.93, 1.01)	0.96 (0.92, 1.00)
Neighbourhood unemployment rate (%)						
<10	6,547	1.0	1.0		1.0	1.0
10–<15	1,017	0.95 (0.76, 1.20)	0.92 (0.73, 1.16)		1.06 (0.99, 1.13)	1.05 (0.99, 1.12)
≥15	468	1.20 (0.92, 1.56)	1.08 (0.83, 1.40)		1.13 (1.02, 1.24)*	1.10 (1.00, 1.21)*
Neighbourhood proportion of families with single mother >10%	3,081	1.09 (0.95, 1.25)	1.04 (0.91, 1.19)		1.07 (1.02, 1.11)**	1.06 (1.01, 1.10)*
Neighbourhood Socio-Economic Factor Index > mean	3,466	1.11 (0.97, 1.28)	1.05 (0.91, 1.20)		1.09 (0.96, 1.23)	1.02 (0.97, 1.06)

^a Effect presented in adjusted odds ratios (confidence intervals), except for Number of ADGs where it is adjusted risk ratio (confidence intervals). The odds ratios and risk ratios were calculated with multi-level logistic and Poisson regression, respectively.

^b Values in Canadian dollars. In the 1990s, one Canadian dollar approximated an average value of \$0.70 in US dollars.

^c **p* value<0.05, ***p* value<0.01, ****p* value<0.001.

this is less of an issue in Manitoba (Sutton et al. 1999). Only 18% of the population did not use the healthcare system in fiscal 1996, and individuals of lower socio-economic status receive more care than their more advantaged counterparts (Reid et al. 2001; Roos et al. 2005). Even the number of ADGs, with its link to healthcare utilization, has “a strong positive linear relationship with the subsequent rate of premature death” (perhaps the best available proxy of overall population health needs) across the province’s small areas (Reid et al. 2002).

Perhaps Canada's greater social support network and universal medical care better protect its population from neighbourhood influences than those of several other countries (Veugelers et al. 2001; Roos et al. 2004; Ross et al. 2000; McLeod et al. 2003). However, other Canadian research has found significant neighbourhood effects on self-reported health, injury levels and BMI (Hou and Myles 2005; Simpson et al. 2005; Veenstra et al. 2005). In Sweden, a country with particularly strong social supports, Malmstrom and colleagues (2001) examined the same location and study population, finding a significant neighbourhood effect on self-reported long-term illness but not on mortality. Only occasionally do neighbourhood characteristics (even after including individual SES) appear to affect the examined health outcomes significantly (Table 4). Summarizing generally weak relationships across several variables and in more than one country is intrinsically difficult.

The study has several limitations. The design of this and similar research may have led to an overestimate of the effects of neighbourhood. Comparison of siblings in families living in the same neighbourhoods has found very weak neighbourhood effects on a number of estimates of well-being (in American, Canadian and Norwegian studies) (Roos and Walld 2007; Solon et al. 2000; Duncan et al. 2001; Oreopoulos 2003; Raaum et al. 2006). Adding more individual-level variables might further reduce neighbourhood effects (Ginther et al. 2000).

The prevalence measures used are affected by incidence and duration of a condition; longitudinal data would have been helpful. Different variables are associated with different stages in the life cycle. Looking at mortality focuses on older ages (and those in poorest health), while measures of subjective health and health utility are relevant for a wider age range. Better measurement of access to resources and psycho-social impacts of deprivation – as well as more powerful research designs – may prove helpful.

It is difficult to infer causality from even strong cross-sectional relationships. The small or non-existent neighbourhood effects found in this study imply problems in devising programs to improve health by focusing on neighbourhood variables. Certainly, neighbourhood improvement can be seen as a good thing in itself. The relationship between self-reported health and neighbourhood unemployment might suggest subjective benefits associated with policy efforts to lower neighbourhood unemployment, but – based on the overall weight of the evidence – such judgments remain speculative. Policies focused on benefiting neighbourhoods may improve health, but the causal pathway seems likely through their effects on individual variables. With individual-level variables disproportionately important, more time-consuming efforts focusing on individuals (and their families) may be more fruitful.

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Does It Matter What You Measure? Neighbourhood Effects in a Canadian Setting

Ce que vous mesurez a-t-il de l'importance? L'effet de quartier dans une région du Canada

by LESLIE L. ROOS, JENNIFER MAGOON AND DAN CHÂTEAU

TABLE 2. Effect of individual characteristics on various health outcomes adjusted for age and gender

		Low self-reported health			Low self-reported health ^c		Low health utility			Low health utility ^c		Psychological distress			Psychological distress ^c		Number of ADGs		Number of ADGs ^c		
	Total N	n	OR ^a	95% CI ^a	OR ^a	95% CI ^a	n	OR ^a	95% CI ^a	OR ^a	95% CI ^a	n	OR ^a	95% CI ^a	OR ^a	95% CI ^a	RR ^a	95% CI ^a	RR ^a	lower	upper
Smoker	2,404	267	1.58	1.35, 1.86	1.81	1.48, 2.21	743	1.50	1.35, 1.68	1.52	1.34, 1.73	415	1.69	1.47, 1.94	1.81	1.54, 2.12	0.99	0.96, 1.02	0.99	0.96	1.03
Body mass index																					
<20	346	33	1.92	1.30, 2.84	1.88	1.24, 2.85	97	1.43	1.11, 1.84	1.42	1.09, 1.85	61	1.18	0.88, 1.59	1.22	0.89, 1.67	1.15	1.08, 1.22	1.12	1.04	1.20
20 ≤27	3,665	223	1.0				840	1.0				487	1.0				1.0				
≥27	2,343	270	1.75	1.45, 2.12	1.85	1.51, 2.26	664	1.21	1.07, 1.37	1.21	1.07, 1.38	294	1.04	0.89, 1.22	1.02	0.86, 1.20	1.12	1.08, 1.16	1.14	1.10	1.19
Missing	1,678	256	1.19	0.94, 1.51	removed		615	1.13	0.97, 1.31	removed		176	0.92	0.76, 1.12	removed		1.15	1.11, 1.20	removed		
Diabetic	326	113	3.77	2.93, 4.84	4.14	2.94, 5.84	140	1.42	1.13, 1.80	1.55	1.14, 2.13	53	1.69	1.24, 2.31	1.79	1.22, 2.64	1.46	1.38, 1.54	1.67	1.55	1.80
Household income ^b																					
<\$20,000	1,459	253	1.0				578	1.0				265	1.0				1.0				
\$20,000–<\$40,000	2,343	237	0.63	0.52, 0.77	0.63	0.51, 0.76	691	0.72	0.62, 0.83	0.65	0.55, 0.77	290	0.61	0.51, 0.74	0.53	0.43, 0.65	0.88	0.85, 0.91	0.85	0.81	0.89
≥\$40,000	3,199	183	0.41	0.33, 0.50	0.40	0.32, 0.49	671	0.51	0.44, 0.58	0.44	0.38, 0.52	349	0.50	0.42, 0.60	0.42	0.35, 0.52	0.88	0.85, 0.91	0.87	0.83	0.91
Missing	1,031	109	0.62	0.49, 0.80	removed		276	0.59	0.49, 0.70	removed		114	0.56	0.44, 0.71	removed		0.88	0.84, 0.92	removed		
Education																					
Less than high school	2,378	386	1.0				874	1.0				325	1.0				1.0				
High school, vocational	2,986	232	0.66	0.55, 0.80	0.51	0.40, 0.65	718	0.74	0.65, 0.84	0.71	0.61, 0.83	388	0.74	0.62, 0.87	0.7	0.57, 0.86	0.94	0.91, 0.97	0.93	0.89	0.97
College, university	2,624	158	0.46	0.37, 0.56	0.34	0.26, 0.43	606	0.64	0.57, 0.73	0.61	0.52, 0.71	302	0.67	0.56, 0.80	0.65	0.53, 0.80	0.93	0.90, 0.96	0.93	0.89	0.97

^a OR, odds ratio; RR, risk ratio; CI, confidence interval. The odds ratios and risk ratios for individual characteristics were calculated with individual-level logistic and Poisson regression, respectively.

^b Values in Canadian dollars. In the 1990s, one Canadian dollar approximated an average value of \$0.70 in US dollars.

^c The indicated analyses were performed only on people with complete data (n=5,573).