Neighbourhood, Family and Health Care

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ABSTRACT

Objective: The effects of family and place on health outcomes may be seriously misestimated by standard analytic techniques. The information-rich settings in several Canadian provinces can provide appropriate designs to minimize biases resulting from omitted variables and measurement error. This paper compares siblings with children living in the same neighbourhood (but not in the same family) in terms of health care utilization and health care costs. A complete history of residential mobility since birth permits an estimate of the effects of exposure to different environments.

Methods: Registry data from a Manitoba cohort born between 1978 and 1985 and continuously resident in the province generated a large sample of same-sex siblings and neighbours (*N* = 18,280). Administrative information on physician billings, hospital inpatient stays, and costs provided data on utilization between ages 12 and 17.

Results: Large effects on the outcome variables were associated with being in the same family (correlations up to 0.50), whereas the correlations representing upper limits on neighbourhood effects were usually small. These neighbourhood correlations typically shrank slightly after adjustment for family effects. Higher neighbour correlations with utilization (particularly ambulatory visits) occurred in rural Manitoba and probably reflect variation in access to care. Higher correlations are associated with relatively small neighbourhoods and with families remaining in the neighbourhood for at least 17 years.

Discussion: Although specific variables taken from administrative data are only marginally predictive, our results emphasize the importance of "family" in affecting health care utilization in Manitoba. The minimal effects of neighbourhood differ from those found by investigators generally using weaker designs and emphasizing the significance of neighbourhood.

MeSH terms: Health services research; siblings; family characteristics; health care costs; environment

La traduction du résumé se trouve à la fin de l'article.

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Recent research has used neighbourhood and family characteristics to study such life course outcomes as health status, teenage pregnancy and educational achievement. A variety of papers focusing on neighbourhood-level variables and their effect on individual health status have produced diverse results.[1] Much of the argument has revolved around whether community context independently affects all residents or whether any effect is due entirely to compositional effects – i.e., to an aggregation of the relationships between individual socio-economic context and individual health status.[2-5] Ginther et al.[6] took a different approach, finding the influence of neighbourhood attributes to diminish as more individual-based variables were added to a model predicting childhood outcomes. Duncan[7] raises the related issue as to "whether apparent neighbourhood effects emerging from our regressions merely reflect unmeasured family factors that affected both choice of neighbourhood and child well-being".

Well-regarded US work has focused on neighbourhood dynamics and on multi-year longitudinal surveys such as the Panel Study of Income Dynamics.[8-10] The National Population Health Survey and Canadian Community Health Survey have included longitudinal components, but long-term follow-up of large numbers of respondents and families has not generally been available in Canada. Although the longitudinal Survey of Labour and Income Dynamics has provided information on Canadians' financial situations and family characteristics, concerns about the accuracy of the data have recently been voiced.[11,12]

Sibling studies highlight important biases due to omitted variables and measurement error in most research attempting to control for individual, family and neighbourhood factors.[9,13] Specific measures of siblings' shared background explain only a portion of sibling correlations on various measures of well-being.[10,14] More complicated designs involving both siblings and "children growing up in the same neighbourhood but not in the same family [can] indicate how much of what is important in the shared environments of siblings lies outside the immediate family".[15] Such sibling/shared environment designs apportion the overall variance in each outcome measure in terms of covariance accounted for

by the sibling variable and by the shared environment. With similar families clustering together residentially, correlations in outcomes experienced by children can provide an upper limit to what is attributable to disparities in neighbourhood background.[10]

However, children living in the same neighbourhood may vary substantially in their residential histories and experiences. Since frequent moves have been found to be detrimental to educational achievement, exploring residential stability per se is valuable.[10,16,17] Since mobility is fairly common, researchers disagree about the importance of explicitly studying such differences. Kunz et al.[18] have argued that relying on a single "time-bound" measure of neighbourhood environment generates only a small bias. On the other hand, Wheaton and Clarke[13] use longitudinal data from the American National Survey of Children to emphasize the importance of early neighbourhood disadvantage on mental health several years later, in early adulthood.

A final question is: How should a neighbourhood be defined? Boyle and Willms[19] find that smaller neighbourhoods lead to stronger estimates of neighbourhood effects. Wheaton and Clarke[13] note the robustness of ecological effects across closely related levels of aggregation; other investigators generally agree.[6,20,21]

Manitoba as a site

Manitoba is especially appropriate for work on families and shared environments. Available administrative data provide population-based information and a large number of respondents; complicated adjustments to increase effective sample size have not been necessary.[10,13] Time and space can be handled in several different ways. Annual information on residential location facilitates study of both movement across neighbourhoods and change in neighbourhoods over time. "Neighbours" can be flexibly defined by varying the distance separating their residences.

The heterogeneity of neighbourhoods across the province provides a wide range of environments for comparison. Among urban census dissemination areas (most of which are in Winnipeg, a city of almost 650,000), areas categorized in the lowest income quintile averaged $28,737 per household in 2001, whereas families living in the highest income quintile areas averaged $96,571. Several bedroom communities and Brandon (the second largest Manitoba city with a 2001 population of 47,482) were found outside Winnipeg, but most rural and northern census dissemination areas were separated by considerable distances. Families in the poorest rural areas had a mean household income of $31,070, and those residing in the most affluent quintile averaged $68,415 per household.

This paper does the following:

1. Compares the influence of family and neighbourhood on health care utilization and costs by examining correlations between siblings and unrelated neighbours inside and outside Winnipeg.
2. Incorporates time and space to better understand these correlations by
   a) testing the importance of size of neighbourhood
   b) considering several points in the early life course
   c) comparing families according to their shared exposure to the same neighbourhood.

DATA

The Population Health Research Data Repository at the Manitoba Centre for Health Policy is built from records processed by Manitoba Health to remove patient identifiers, such as name and address, while preserving the capacity to link records together to form individual histories of health care use. Data sets are typically put together as needed for each study; more detailed descriptions of the information in the data repository are provided elsewhere.[22,23]

Since 1970, the Manitoba Health registry attaches to every birth a family number (called the Registration Number or REGNO), which links the infant to the "family head", usually the father. When an individual turns 18 years old, he or she receives his or her own registration number. On marriage, a female receives the registration number of her husband. Before 1984, individuals were specified using a combination of family number, date of birth and sex. Each individual's history of different family numbers is maintained in the research registry. An individual Personal Health Identification Number (PHIN) was assigned to each provincial resident in 1984. Subsequently, a PHIN was assigned at birth or when a person moved into Manitoba. Critical information is protected by encryption before data are passed to the Centre for Health Policy.

Each substantive file is checked against a research registry at the Centre for Health Policy for the accuracy of the identifiers and for such particular information as date of in-hospital death.[22] The research registry, coordinated with Vital Statistics files, provides information on place of residence using a six-digit postal code, as well as dates of arrival and departure (births, deaths and moves) for any date since 1970.[24] Time-sensitive data elements (place of residence, family composition) are updated using "snapshot" registries provided every six months.

As described in Forget et al.,[25] the database includes direct information on physician billings, excluding some patient visits outside the province and some physician salaries (i.e., those of trainees and those paid for specific services such as intensive care unit coverage).[26] The costs of inpatient hospital care and day surgery procedures have been estimated by applying the Manitoba average cost per weighted case to each discharge.[27] These figures are lower than those reported by the Canadian Institute for Health Information (CIHI),[28] because costs were allocated to individual patients and then aggregated. Some costs are not captured, either because they are not attributable to individual patients (such as the costs of running some clinics in hospitals) or because patient-specific data are lacking (costs attributable to northern nursing stations, blood products or CancerCare Manitoba). Finally, hospital costs are accounted for differently from the CIHI method. The number of ambulatory visits and the number of hospital inpatient stays are other utilization variables studied. Data on costs and the number of ambulatory visits are log transformed to produce somewhat more normal distributions.

DESIGN

Siblings (including twins) and non-related children from neighbouring families were sampled from seven Manitoba cohorts

born in 1978-1982 and 1984-1985. The cohort included over 99% of children born in Manitoba in these years and remaining in the province up to June of their 18th year. The twins made up a small portion of the siblings (between 3% and 4%), and sensitivity testing showed few differences when data on the twins were eliminated. The sample was drawn for multiple purposes. The cohort born in 1983 was not included because important educational data (Grade 12 provincial tests) were not available for the school year 2000/2001 (when the 1983 birth cohort would normally be in Grade 12).

Both mother's identification number (an encrypted PHIN) and REGNO were used to define siblings. Children born to the same mother but different fathers and to the same father but different mothers (half siblings) were included in this study as siblings. Several checks applied to the seven years of birth cohorts (involving missing data, the number of children designated as having the same mother and father, and complicated blended families) have indicated the algorithm for defining siblings to be highly accurate.

Family members' place of residence follows that of the family head. The sample was drawn to ensure that the children in each family were indeed siblings, that essential elements in the family relationship were present from birth to age 17.5 and that Manitoba residence was maintained over that period. Siblings having the same family number, both at birth and at age 17.5, were included in the sample (population N = 65,008). Siblings might also be in a family with a change in head. Each sibling would have a family number that was the same at birth; the number would change to that of another family number by age 17.5. These family numbers would not belong to any other group at either point in time (population N = 13,164). Two types of family were not included in the sample: blended families (children with different initial family numbers coming together under one family number, population N = 827) and split families (children with the same family numbers earlier having different family numbers later, population N = 2,865). A small number of children (145) met the criteria for both blended and split families.

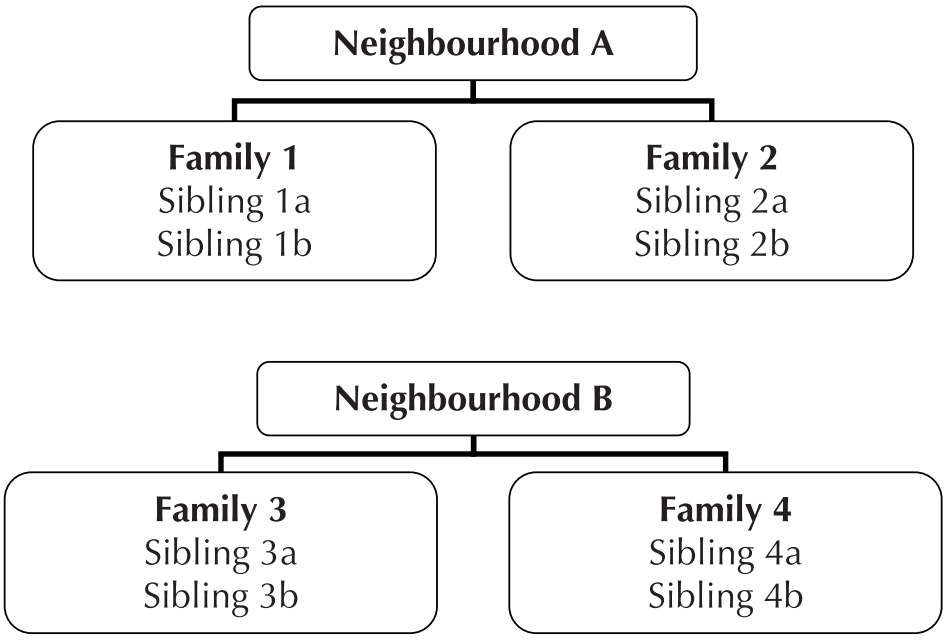

Figure 1. Sibling - Neighbourhood designs

Defining neighbourhood

"Neighbourhood" can be conceptualized in several ways using Canadian administrative data. Each six-digit postal code "generally refers to one side of a city street, often over only one block or a single apartment building."[29] In Winnipeg, several postal code areas are typically contained within a Statistics Canada dissemination area. Rural areas characteristically combine a six-digit postal code with a census dissemination area. The dissemination area (from the 2001 census) is the smallest unit for which most information on area characteristics (household income, education) is available. Census dissemination areas are designed to have between 400 and 700 residents, but a few are smaller or larger.

Of same-sex sibling pairs, 91.5% could be compared with a similar pair in the same census dissemination area (Figure 1). Each comparison group paired two same-sex siblings in each family with those of another family in the same neighbourhood. Including those inside and outside of Winnipeg, 63.3% of the groups sampled (N = 2,894) resided within the same postal code area. Using the centroids of residential postal codes, linear programming minimized the distance between family pairs in different postal code areas within each census dissemination area (36.7% of the sample, N = 1,676). Thus, neighbourhood is defined as either a particular postal code area (when a pair of families lives within a single area) or two postal codes close to each other in the same census dissemination area (with each paired family having a different residential postal code). Given odd numbers of families (1, 3, 5, etc.), the linear program eliminated that family whose place of residence proved most difficult to pair with another. Of the families paired across different postal code areas, 90.2% were estimated to reside less than 0.5 kilometres distant from each other.

The large number of Manitoba siblings, families and neighbourhoods allows sampling without complicated adjustments directed towards increasing the effective number of cases.[10] Having non-overlapping pairs of same-sex siblings and neighbours, using only two sisters (or brothers) from each family and eliminating the odd-numbered family allowed use of the relatively simple model described below.

Analytic approach

Solon et al. [10] have formalized "an additive model of the effect of family and extra-familial context on some outcome of interest." They first confirm that the *sibling* covariance in a child outcome of interest is the sum of (a) shared family variance, (b) shared neighbourhood variance and (c) twice the covariance between family and neighbourhood factors. Next they show that the covariance between *neighbouring* children from *different* families is the sum

TABLE I

Characteristics of Birth Cohorts (1979–1982, 1984–1985) and Study Sample

		All Birth Cohort Members	Siblings in Families with at Least one Same-Sex Pair	Study Sample of Same-Sex Pairs*
Place of Residence and Age				
Winnipeg	Percent	47.6	40.7	37.9
Age at Jan 1, 2000	Mean (SD)	18.1 (2.40)	18.2 (2.27)	18.1 (2.24)
Social Variables				
Age of mother at first birth	Mean (SD)	23.3 (4.45)	22.9 (4.12)	23.0 (4.15)
Number of moves (age 7.5 to 17.5)	Mean (SD)	0.82 (1.37)	0.72 (1.30)	0.68 (1.27)
Birth order	Mean (SD)	2.00 (1.13)	2.33 (1.32)	2.33 (1.31)
Number of children in family	Mean (SD)	3.00 (1.49)	3.70 (1.74)	3.61 (1.71)
Mother married at time of birth (changes with each child)	Percent	84.3	88.7	89.0
Months on income assistance (age 7.5 to 17.5)	Mean (SD)	4.32 (18.01)	3.54 (16.48)	3.27 (15.85)
Infant Health				
5-minute Apgar	Mean (SD)	9.13 (0.82)	9.15 (0.80)	9.15 (0.82)
Birth weight (grams)	Mean (SD)	3,447 (547)	3,450 (564)	3,450 (570)
Gestation (weeks)	Mean (SD)	39.4 (1.76)	39.4 (1.80)	39.4 (1.81)
Costs, Visits and Stays				
Total hospital and physician costs (age 12-17 – 1993$)	Mean (SD)	1,164 (4,948)	1,126 (5,591)	1,069 (5,098)
Number of ambulatory visits (age 12-17)	Mean (SD)	14.88 (13.00)	13.60 (11.88)	13.61 (11.86)
Number of hospital inpatient stays (age 12-17)	Mean (SD)	0.21 (0.82)	0.21 (0.72)	0.20 (0.68)
Number of boys		40,082	12,962	9,700
Number of girls		37,974	11,789	8,560
Number of families		56,157	10,540	9,018

* 112 families contributed a sibling pair of both sexes, so the total number of sibling pairs used was 9,130.
The calculations for "age of mother at first birth", "number of children in family" and "birth order" were based on files that go back to 1970 for the mother. This leads to a slight overestimate of age at first birth and a slight underestimate of the other two variables (since some children will have been born before 1970). Each twin was given the same birth order score (based on being the first-born twin).

of (1) the shared neighbourhood variance (identical to (b) above) and an unambiguous component of the true neighbourhood effect, (2) twice the covariance between family and neighbourhood factors (identical to (c) above) and (3) the covariance in family backgrounds among neighbouring children.[30] Two elements in Solon's equations suggest an upward bias in the neighbour correlation: (i) sharing similar backgrounds with neighbours (component 3 above) is not a true neighbourhood effect and (ii) the entire covariance between family and neighbourhood factors (component 2) is attributed to neighbourhood effects in calculating the correlation. Given ambiguity vis-à-vis the appropriate allocation of covariance, the neighbour correlation appears to be overly generous in estimating the possible influence of the shared environments (including both measured variables and those that cannot be measured).[10,30]

RESULTS

Representativeness

How representative are the siblings studied? All those in the birth cohort, siblings (including twins) in families with at least one same-sex pair, and siblings (including twins) sampled in this study are compared in Table I. Only those remaining in Manitoba up to the age of 17.5 were studied. Given larger families in rural areas, the study sample underestimates the number of Winnipeg children. The sample family was less likely to have received income assistance and to have changed postal codes; the mother was more likely to have been married at the time of birth of each child. The sampled children had slightly fewer ambulatory visits in the age 12-17 period. Most of these differences were due to recruitment of the study sample from the pool of families with at least one same-sex pair of children (Table I).

Regression on observed characteristics

Measurable aspects of family background might be subtracted from the shared family background component (component 3 above) to tighten the limits on the neighbour correlations. Duncan et al.[30] describe such adjustment as "calculating residuals from an auxiliary regression of child outcomes on observed family characteristics and then correlating the residuals across neighbouring children". The six variables in the auxiliary regression used in this study were age of mother at first birth, number of moves (between the child's age of 7.5 and 17.5), marital status at birth of child, birth order, family size and whether or not the family received income assistance (between the child's age of 7.5 and 17.5). These variables from administrative data are as predictive of such later outcomes as educational achievement as those used in the Panel Study in Income Dynamics.[31] However, for the health care utilization outcomes, their predictive power (R^2 of about 0.02) was quite weak. Adjustments reduced the unadjusted correlations only slightly.

Admittedly, the appropriate choice of variables to predict scores on any outcome variable (and subsequent analysis of residuals) is not completely clear. In particular, the "age of mother at birth of first child" variable might plausibly be influenced not only by family but by a neighbourhood component. On the other hand, since many other family characteristics might have been adjusted for but were not (household income, maternal depression, parental education, discipline style), the adjusted neighbour correlations are likely to represent an upper limit on the measurement of neighbourhood effects.

Winnipeg and outside Winnipeg

Table II summarizes the results for boys and girls inside and outside Winnipeg, showing the sibling correlations to be much larger than the adjusted neighbour correlations. The higher neighbour correlations for ambulatory visits outside Winnipeg probably reflect differences in access to physicians across the province's rural areas. Statistics Canada's urban/rural

TABLE II

Sibling and Neighbour Correlations for Health Care Utilization Inside and Outside Winnipeg

	Inside Winnipeg						Outside Winnipeg					
	Boys (1,868 families)			Girls (1,586 families)			Boys (2,982 families)			Girls (2,694 families)		
	Hospital & Physician Costs	Number of Ambulatory Visits	Number of Hospital Inpatient Stays	Hospital & Physician Costs	Number of Ambulatory Visits	Number of Hospital Inpatient Stays	Hospital & Physician Costs	Number of Ambulatory Visits	Number of Hospital Inpatient Stays	Hospital & Physician Costs	Number of Ambulatory Visits	Number of Hospital Inpatient Stays
Correlations (unadjusted)												
Sibling	0.310†	0.462†	0.029	0.403†	0.505†	0.138†	0.289†	0.462†	0.105†	0.301†	0.500†	0.190†
Neighbour	0.01	0.026	0.023	0.02	0.036*	0.007	0.085†	0.168†	0.057†	0.052†	0.187†	0.053†
Correlations (adjusted)												
Sibling	0.307†	0.460†	–	0.390†	0.497†	–	0.279†	0.421†	–	0.282†	0.449†	–
Neighbour	0.017	0.030*	–	0.013	0.022	–	0.071†	0.106†	–	0.041*	0.130†	–

A log transformation was applied (in all calculations) to compute the correlations for hospital and physician costs and for number of ambulatory visits. Because a large proportion of those sampled had no hospital inpatient stays, adjusted correlations were not appropriate for this variable. The neighbour correlations were based on 18,260 unrelated neighbours from 9,130 families. Sibling 1a was compared with sibling 2a, sibling 1b with 2b, sibling 3a with 4a, and so forth (see Figure 1).

* $p < 0.05$

† $p < 0.01$

TABLE III

Neighbour Correlations for Health Care Utilization by Statistics Canada's Urban/Rural Typology

	Urban/Rural Typology				
	Urban Core	Urban Fringe	Rural Fringe inside CMA	Urban Area Outside CMA	Rural Fringe Outside CMA
Neighbour correlations (unadjusted)					
Hospital and physician costs	0.032†	0.06	0.04	0.02	0.095†
Ambulatory visits	0.047†	0.00	0.041	0.073†	0.226†
Hospital inpatient stays	0.02	0.03	0.01	0.01	0.075†
Neighbour correlations (adjusted)					
Hospital and physician costs	0.032†	0.08	0.04	0.02	0.084†
Ambulatory visits	0.040†	0.00	0.04	0.052*	0.167†
Hospital inpatient stays	–	–	–	–	–
N (families)	3,912	110	556	1,130	3,244

CMA = Census Metropolitan Area

These correlations were based on 17,904 unrelated neighbours from 8,952 families. A few families had postal codes that did not fit in Statistics Canada's framework.

* $p < 0.05$

† $p < 0.01$

typology provides a slightly different perspective (Table III). The highest correlations were for ambulatory visits in the "rural fringe outside the Census Metropolitan Areas", again suggesting the role of access and distance.

Distance and neighbourhood

Both unadjusted and adjusted correlations can be arranged by neighbours' distance from each other (within the same Statistics Canada dissemination area) (Table IV). This suggests that "neighbourhoods" should be conceptualized as quite small in size, perhaps in terms of units smaller than the dissemination area. Inside Winnipeg, similar low correlations were found among neighbours assigned distances of "zero kilometres" and "greater than zero but less than 0.5 kilometres". Several of these correlations were statistically significant, given the large number of families involved. Although the measurement of distance between neighbours outside Winnipeg is less precise, the strongest correlations (unadjusted and adjusted) involved the number of ambulatory visits among neighbours within the same municipality. Such relatively close neighbours were a large percentage (90%) of those matched outside Winnipeg.

Life course and shared exposure

Life course perspectives can be integrated with the characteristics of the neighbourhood in which a child lives. To what extent does past context influence current well-being? Are certain developmental stages more important than others? Wheaton and Clarke[13] have suggested that neighbourhood influences on functioning in early childhood might extend to an effect on variables measured at 17 or 18 years of age.

To test the possible importance of place of residence early in life, neighbours were defined using two other points in the life course: early childhood (younger sibling age six) and late childhood (younger sibling age 12). The neighbour correlations in Tables II and III were rerun using the "early childhood" and "late childhood" groupings. Correlations using these new groupings were uniformly close to those presented in the earlier tables. Making any statement other than that neighbour correlations for health care utilization were quite weak seems unwise.

We can also compare sibling and neighbour correlations according to the duration of time spent by both families in the neighbourhood. If neighbourhood were highly important, shared exposure would predict the strength of the correlation with the health outcomes. Family pairs were grouped according to the amount of time in common between the two families in the neighbourhood: 0-5 years, 6-11 years, 12-16 years and never moved. These scores were computed by taking the shorter of the two families' duration at the postal code occupied at age 17 of the older child.

TABLE IV

Neighbour Correlations for Health Care Utilization by Distance between Neighbours

	Distance Between Neighbours					
	Inside Winnipeg			Outside Winnipeg		
	Zero km (essentially same postal code)	Coordinates Less than 0.5 km Apart	Greater than 0.5 km Apart	Same Coordinates	Coordinates Less than 0.5 km Apart	Greater than 0.5 km Apart
Neighbour correlations (unadjusted)						
Hospital and physician costs	0.046*	0.029*	0	0.083†	0.072	0
Ambulatory visits	0.047*	0.052†	0	0.192†	0.092*	0.009
Hospital inpatient stays	0.017	0.008	0	0.061†	0.077	0
Neighbour correlations (adjusted)						
Hospital and physician costs	0.045*	0.028	0	0.071†	0.061	0
Ambulatory visits	0.041*	0.045†	0	0.134†	0.084*	0.027
Hospital inpatient stays	–	–	–	–	–	–
N (families)	1,056	2,254	144	5,130	364	182

These correlations were based on 18,260 unrelated neighbours from 9,130 families. Some postal codes outside Winnipeg were within the same municipality and assigned the same geographic coordinates. Families paired outside Winnipeg were likely to be farther apart than their counterparts inside Winnipeg. Correlations computed using the SAS PROC MIXED procedure cannot go below zero. PROC MIXED is used to generate *p* values in all tables.
* $p < 0.05$
† $p < 0.01$

TABLE V

Neighbour Correlations by Years of Shared Exposure

	Shared Exposure							
	Inside Winnipeg				Outside Winnipeg			
Neighbour correlations (unadjusted)	0-5 years	6-11 years	12-16 years	Never moved	0-5 years	6-11 years	12-16 years	Never moved
Hospital and physician costs	0	0	0.018	0.145†	0.023	0.056*	0.001	0.148†
Ambulatory visits	0.03	0.024	0	0.144†	0.156†	0.120†	0.151†	0.220†
Hospital inpatient stays	0	0.008	0.011	0	0.042*	0.034	0	0.105†
Neighbour correlations (adjusted)								
Hospital and physician costs	0	0	0.025	0.152†	0.011	0.064†	0	0.128†
Ambulatory visits	0.025	0.015	0	0.146†	0.095†	0.100†	0.107†	0.148†
Hospital inpatient stays	–	–	–	–	–	–	–	–
N (families)	1,562	1,014	564	314	1,878	1,218	616	1,964

These correlations were based on 18,260 unrelated neighbours from 9,130 families.
* $p < 0.05$
† $p < 0.01$

Thus, if one family had lived in the neighbourhood for 15 years, but the matching family moved in 3 years before age 17, that family pair would be in the 0-5 year group. Long shared exposures appear to be critical for neighbours to develop even roughly correlated patterns of utilization (Table V); many of the families who never moved during the study period would have resided in the same place for a considerably longer time. Again, weak relationships are difficult to interpret; the data suggest a threshold effect in terms of cumulative, shared exposure to a neighbourhood environment.[32]

DISCUSSION: PREDICTING UTILIZATION

Because need, access and socio-economic status interact in determining health care utilization, straightforward regression analyses of measurable aspects of family background do not explain large amounts of variance in utilization in Manitoba. Utilization is strongly related to health,[33,34] while socio-economic status affects utilization in ways anticipated by Link's "fundamental cause" approach.[35] This approach emphasizes the enduring relationship between socio-economic disparities and health: high status individuals "are more able to avoid risk by adopting currently available protective and therapeutic strategies to minimize risks".[35] Such individuals will differentially use the health care system, adopting innovations (cancer screening, cardiovascular surgery, radiological services) at a higher rate than would be anticipated by measures of need or ease of access.[36-38] On the other hand, residents of low socio-economic status neighbourhoods make higher use of primary care physicians than do their counterparts in more affluent neighbourhoods. In urban Manitoba, residents of less wealthy neighbourhoods are both more likely to receive ambulatory care for conditions for which hospitalization can often be avoided and more likely to be hospitalized.[39] Some issues around quality of access (particularly preventive services) have been actively addressed, but continuity and comprehensiveness of care remain outstanding issues.[40,41] Martens et al.[42] summarize considerable complexity by saying that "'urban is not necessarily synonymous with good health and better access to services, nor is rural or remote synonymous with poor health and inadequate health care." The interactions among variables make prediction difficult.

Looking at the utilization data in terms of neighbourhood does not seem very fruitful; some effects may be present when neighbourhoods are small in size and families are residentially stable. These findings suggest that patterns of health care consumption change very slowly with residence in a new neighbourhood. Studying length of residence in more depth may prove interesting, particularly since US findings vis-à-vis educational attainment were rather different.[10] Neighbourhood seems more influential outside Winnipeg, but access may play a major role here. Our

overall results present a rather different perspective on place than that found by investigators emphasizing the importance of neighbourhood environments on health.[43]

As well, this paper may also reflect the role of place specifically in Canada. Although Manitoba neighbourhoods are characterized by considerable inequality in socio-economic status, such inequality is less than that in most US jurisdictions.[44] Several lines of evidence and two major literature reviews have suggested contextual factors (income inequality, neighbourhood social environment) to be more important determinants of health in the United States and the United Kingdom than in Canada and other developed countries.[23,44-50] A recent analysis showed small but significant between-neighbourhood variation in health status in Montreal even after controlling for a variety of socio-demographic and behavioural variables at the individual level.[51] On the other hand, Finnish investigators have suggested that "rather than the characteristics of areas, other social contexts, such as peer groups and family settings, may be more fruitful targets for further research".[52]

One reviewer suggested that the social features characterizing neighbourhoods seem likely to shape families and individual lives, and this seems more probable for some variables (such as crime and the perception of safety) than others (such as health care utilization). US research incorporating rather dramatic changes in neighbourhood environment (by moving volunteer low-income black families) has led to positive differences in adult employment and children's developmental outcomes.[29] Children raised in extreme environments or with special sensitivity to such environments may be especially influenced, but for most adolescents, growing up in the same family is clearly much more important for health care utilization than growing up in the same neighbourhood.[10,15]

Considerable effort seems justified in better measurement of existing social concepts and development of new ones. Major US longitudinal surveys and previous registry work facilitate the definition of important family variables.[7,9,24] This paper has simplified matters by eliminating split and blended families from the sample. Although marital status at the time of birth was used as a variable, two-parent and single-parent families have not been differentiated. Future efforts dealing with family structure might start with Ginther and Pollack's [31] analysis using the Panel Study in Income Dynamics.

The large number of cases available and the ability to specify residential location at different times in the life course present generally underexploited research opportunities. We have employed a relatively strong design and information on neighbourhood and family to study health care utilization. The methodology is particularly appropriate for dealing with selection biases, but better ways to incorporate life course and shared exposure perspectives may exist. A number of additional outcomes associated with well-being (educational, social, attitudinal) need to be studied to improve our knowledge of what is truly important about neighbourhoods.

Although the specific data available vary somewhat, information-rich environments similar to Manitoba's have been identified elsewhere in Canada and Australia.[53] With strict controls to preserve confidentiality and privacy, outcomes for several types of families and for other family members (such as spouses) within a shared environment can be compared. Both the general methodology and specific techniques (such as the sibling-neighbourhood design and the use of linear programming) in this paper are of broader applicability. Space and time, family and place can all be used in creative ways.

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RÉSUMÉ

Objectif : L'influence de la famille et du lieu sur les résultats sanitaires peut être gravement mésestimée par les techniques d'analyse ordinaires. Les milieux riches en information qui existent dans plusieurs provinces canadiennes peuvent présenter des modèles d'étude appropriés lorsqu'on veut réduire les biais dus à l'omission de variables et aux erreurs de mesure. Dans cet article, nous comparons des frères et sœurs avec des enfants vivant dans le même quartier (mais pas dans la même famille) du point de vue de leur utilisation des soins de santé et des coûts des soins de santé reçus. En ayant les antécédents complets de la mobilité résidentielle depuis la naissance, il est possible d'estimer les effets de l'exposition à différents milieux.

Méthode : Nous avons utilisé les données du registre manitobain pour une cohorte née entre 1978 et 1985 et ayant continuellement résidé dans la province pour produire un vaste échantillon de frères et sœurs et de voisins du même sexe (N = 18 280). Des données administratives sur les factures de médecins, les hospitalisations et les coûts ont permis de calculer les taux d'utilisation des services de santé par les enfants de 12 à 17 ans.

Résultats : D'importants effets étaient associés au fait d'appartenir à la même famille (corrélations avec les variables de résultat pouvant aller jusqu'à 0,50), tandis que les corrélations importantes (aux limites supérieures) pour l'influence du quartier étaient faibles dans l'ensemble. Ces corrélations relatives au quartier diminuaient en général légèrement lorsqu'on tenait compte des effets familiaux. Des corrélations plus fortes entre le quartier et l'utilisation des services de santé (en particulier les visites sur pied) ont été observées dans les régions rurales du Manitoba; elles traduisent probablement des écarts dans l'accès aux soins. Les corrélations les plus fortes sont associées aux quartiers relativement petits et aux familles ayant habité le quartier pendant au moins 17 ans.

Analyse : Les variables particulières tirées des données administratives n'ont qu'une valeur prédictive marginale, mais nos résultats soulignent l'important effet de la « famille » sur l'utilisation des soins de santé au Manitoba. Les effets minimes du quartier diffèrent de ceux trouvés par les chercheurs qui utilisent en général des modèles d'étude plus faibles et qui mettent l'accent sur l'importance du quartier.