Exploring Rural Health Inequalities at a Local Scale
The Case of Portneuf, Québec

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ABSTRACT

Background: The most common way of accounting for the countryside in health studies has been to compare it, as a whole, to the city. Furthermore, most of the work on small area health inequalities has been confined to major urban centres. To counter this trend, in this paper, we explore small area health inequalities in the predominantly rural county of Portneuf (population = 44,545), Québec. Such information can be of interest for local health planning.

Methods: Three sources of data were used to define neighbourhood units: historical data, socio-economic data and perceptions of local stakeholders. Demographic, socio-economic and general health status indicators were calculated by neighbourhood unit. For health status indicators, data came from mortality files (1998 to 2002), hospitalization files (2001/02) and the 2001 census for disability (individuals who reported being often limited in their daily activities) and the reference population.

Results: The county of Portneuf was subdivided into 8 neighbourhoods. Differences between neighbourhoods were noticeable for demographic, socio-economic and all health status indicators. The greatest differences were found between the town of Pont-Rouge (population = 4,975) and the hinterland of the towns of Donnacona (population = 6,125) and Saint-Marc-des-Carrières (population = 3,160). The most striking was a difference of 6 to 8 years of disability-free life expectancy between the two groups, to the advantage of Pont-Rouge.

Conclusion: Although measuring rural health inequalities at a local level has some methodological limitations, true health inequalities exist in the county of Portneuf. These now need to be examined further.

MeSH terms: Rural health; small-area analysis; health status indicators

DATA AND METHODS

The county of Portneuf spans a 40-kilometre area west of downtown Québec City. The county covers more

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than 4,000 square kilometres of land made up of mountains, forests, farms, lakes and rivers. Its major economic activities are typical of rural areas: agriculture, forestry and manufacture of wood, metals and non-metallic mineral-related products. Portneuf has a total population of about 45,000 individuals* scattered along rural routes or clustered in small towns such as Saint-Raymond, Pont-Rouge, Donnacona and Saint-Marc-des-Carrières. It consists of 18 municipalities and 3 non-organized territories and, since 1981, corresponds to a County Regional Municipality (MRC) with various responsibilities with regard to land planning and development. The county of Portneuf is also the area of a Local Services Network (RLS)†, one of the main gateways to the health care system in Québec. RLSs offer various services, including medical consultation, nursing care, pregnancy follow-up, home care and prevention. In Portneuf, accessibility to basic medical, dental and pharmaceutical services is good throughout the county. However, only Saint-Raymond has a small general hospital.

Defining neighbourhood units
No consensus exists on the way of defining small areas or neighbourhood units. Also, producing meaningful spatial units for local health analysis has important methodological challenges, especially in the countryside. To define these units, we adopted a threefold approach, combining historical, socio-economic and perceptual material. First, all subdivisions used by local administrations and institutions over the past 40 years were integrated into a geographic information system (GIS) and mapped. Every subdivision was weighted by its length and period of use and by its spatial accuracy. Second, major socio-economic areas drawn from a cluster analysis of Canadian census measures, by dissemination area, were put on another map. Finally, a focus group exercise with 8 local stakeholders from different fields (MRC and municipalities, RLS and community groups) was used to validate, complement and integrate the boundaries that came out from the previous work. Participants were free to use elements from the above maps or to introduce their own criteria. The only restrictions were that such units should be a sum of contiguous dissemination areas and reach an average of 5,000 inhabitants (±3,000). In the end, participants modified the above maps to take into account criteria such as social ties, sense of place and common share of public services.

General health status measures
We looked at recommended indicators of population health status for rural communities. We began with life and disability-free life expectancies at birth. Considered one of the best summary measures of health, disability-free life expectancy combines information on mortality and disability to express both life span and quality of life. We used a modified version of the Sullivan method to calculate disability-free life expectancy. Second, we measured premature (below 65 years of age) all-cause mortality, morbidity and hospitalization. These measures are useful to identify many preventable events for which public health interventions are possible. In addition, they are relatively free from the influence nursing homes or senior residences might have on the overall population health status of local areas.

Data on mortality come from the Québec deaths file, years 1998 to 2002; data on hospitalization from the Québec hospitalizations file, year 2001/02; and data on disability, from the Canadian census, year 2001. The disabled are defined as those having answered positively to census questions 7 or 8 and, more precisely, having said their activities were often limited at home, at work, at school or elsewhere. All indicators were adjusted for the age and sex structure of the 2001 Québec population and reported with confidence intervals and difference tests (p<0.05). Statistical comparisons were made between neighbourhood units and the county of Portneuf, as a whole.

RESULTS
Participants of the focus group agreed on subdividing the county of Portneuf into four geographic sectors (North, East, Centre and West) and splitting them into their urban and rural parts, although relying on dissemination areas only allowed an approximate distinction between these parts. The result was a total of 8 neigh-

* The population of three dissemination areas (1% of Portneuf’s population), corresponding to one prison and two large nursing homes, were excluded from the analyses.
† Formerly Local Community Services Centre (CLSC).
bourhood units (Figure 1). Four of them are mainly associated with the small towns of Saint-Raymond (unit 1), Pont-Rouge (unit 4), Donnacona (unit 5) and Saint-Marc-des-Carrières (unit 7) while the others cover their hinterland. There are noticeable demographic and socio-economic differences between these units (Table I). Sector East (units 3 and 4) differs from sector West (units 7 and 8), the former having a younger, richer and more educated population. Unit 1 contrasts with the rest of the county, with an older, poorer and less educated population and with a higher proportion of people living alone and in single-parent families.

Likewise, there are noticeable differences in life and disability-free life expectancies among the small areas of Portneuf (Table II and Figure 2). The best measures are in sector East, and particularly Pont-Rouge (unit 4). Men and women from these areas can expect to live four years more in good health than their overall Portneuf counterparts. This advantage goes up to six and even eight years when the comparison is made with unit 6 and unit 8, the hinterland of Donnacona and Saint-Marc-des-Carrières. When mortality and disability among people below 65 are considered, such disparities persist (Table III). While mortality and disability are relatively low in sector East (mainly unit 3), the highest mortality is seen in sector Centre (mainly unit 6) and the highest disability in sector West (mainly unit 8). When hospitalization is considered, the last two sectors contrast most, with high rates in sector Centre and low rates in sector West. Similarly, hospitalization rates differ between units 1 and 2 in sector North. Here, Saint-Raymond (unit 1) displays the highest hospitalization rate in Portneuf.

**DISCUSSION**

Our results suggest that the rural county of Portneuf constitutes a heterogeneous entity made of small areas, sectors and neighbourhoods, with their own geographic and...
### Table II

<table>
<thead>
<tr>
<th>Sector</th>
<th>Neighbourhood</th>
<th>LE CI</th>
<th>DE CI</th>
<th>Disability-free Life Expectancy CI</th>
<th>Female</th>
<th>Male</th>
<th>Total</th>
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<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>North</td>
<td>Saint-Raymond ¶</td>
<td>82.9</td>
<td>(81.4;84.5)</td>
<td>76.0 (74.5;77.5)</td>
<td>71.8</td>
<td>76.0</td>
<td>79.3</td>
</tr>
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<td></td>
<td>Hinterland</td>
<td>83.1</td>
<td>(81.4;84.9)</td>
<td>77.9 (76.5;79.6)</td>
<td>75.4</td>
<td>78.2</td>
<td>80.3</td>
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<td>East</td>
<td>87.3*</td>
<td>(85.3;89.3)</td>
<td>82.9* (81.7;84.1)</td>
<td>81.4*</td>
<td>85.6</td>
<td>83.8</td>
</tr>
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<td>Donnacona</td>
<td>82.2</td>
<td>(80.8;83.8)</td>
<td>78.2* (76.0;79.6)</td>
<td>75.4*</td>
<td>79.5</td>
<td>82.4</td>
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<tr>
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<td>West</td>
<td>82.8</td>
<td>(81.4;84.3)</td>
<td>78.2* (76.0;79.6)</td>
<td>75.4*</td>
<td>79.5</td>
<td>82.4</td>
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<tr>
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<td>83.2</td>
<td>(82.4;84.0)</td>
<td>78.2* (76.0;79.6)</td>
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<td>79.5</td>
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<tr>
<td></td>
<td>Québec Province</td>
<td>83.2</td>
<td>(82.4;84.0)</td>
<td>78.2* (76.0;79.6)</td>
<td>75.4*</td>
<td>79.5</td>
<td>82.4</td>
</tr>
</tbody>
</table>

* LE or DE statistically different from Portneuf, as a whole (p<0.05).

18 Postal Code Conversion File (PCCF+) with the area deaths (n=433) by comparing the area assigned through the postal code (6-digit postal code) and that of the census (dissemination area); and such error is frequent in the countryside. We obtained the validated area of residence but did not find any significant change from previous rates, as shown in Table III. Hence, true health disparities seem to be present in the county of Portneuf. Residents of sector East and especially Pont-Rouge (unit 4) have the highest life and disability-free life expectancies at birth and the lowest premature mortality and disability rates. Residents of units 6 and 8, located in the hinterland of Donnacona and Saint-Marc-des-Carrières, are the unhealthiest. These disparities partly mirror socio-economic variations, as noted in Table I. For hospitalization, however, another pattern emerges. Now, units 6 and 8 differ as do units 1 and 2. In fact, the lowest hospitalization rates pertain to the county’s most remote areas and the highest to Saint-Raymond. Here, accessibility to hospital services might be at work. Let us recall that such services are only available in Saint-Raymond.

Measuring local health disparities with mortality and hospitalization records is not free from errors. One of these is location error, which occurs when the software assigns an individual to a wrong area of residence due to an imperfect match between the geography of administrative records (6-digit postal code) and that of the census (dissemination area); and such error is frequent in the countryside. We therefore validated the area of residence of all premature deaths (n=433) by comparing the area assigned through the Postal Code Conversion File (PCCF+) with the area obtained after reading the address on the death certificate and matching it with its geographical coordinates, provided in the MRC of Portneuf valuation rolls. This comparison revealed divergent results between the PCCF+ and our procedure in about 52% of deaths at the dissemination area level, and 14% of deaths at the neighbourhood level. We recalculated mortality rates by neighbourhood on the basis of the validated area of residence but did not find any significant change from previous rates, as shown in Table III.

Hence, true health disparities seem to be present in the county of Portneuf. For local decision-makers, this simple conclusion represents a noticeable improvement in their knowledge of residents’ health. Until now, the only information available in Québec was for large rural units and for counties, as a whole. Targeting vulnerable groups, popula-
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health.22,23 First, data collected on local trends in research on neighbourhood and two ways that now represent promising work, these sources will be examined in public health planning, 20 and depicting illustrations or areas, represents a basic strategy in research tools – a health survey, administrative data collection and interviews with working, family and local environments – inequalities and the living environments – long-term research project on health explained in order to provide addition- first step in that direction. These dispari- ties at a local level is feasible and worth- while. The county of Portneuf might differ from other rural areas in Canada but, as the tools used here are available across the country, such a study can be undertaken elsewhere.

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RÉSUMÉ

Contexte : Jusqu’à maintenant, dans les études de santé, le monde rural a surtout été considéré globalement, en le comparant à la ville, et l’intérêt pour les inégalités locales de santé s’est confiné aux grandes villes. Dans cet article, nous explorons l’existence d’inégalités de santé à l’échelle de petits territoires dans le comté principalement rural de Portneuf (population = 44 545), au Québec. La connaissance de telles inégalités peut s’avérer utile pour les planificateurs locaux.


Résultats : Le comté de Portneuf a été subdivisé en 8 unités de voisinage. Des différences entre ces unités sont perceptibles tant sur le plan démographique et socio-économique que pour tous les indicateurs de santé considérés. Les plus fortes différences ont été trouvées entre la ville de Pont-Rouge (population = 4 975) et l’arrière-pays des villes de Donnacona (population = 6 125) et de Saint-Marc-des-Carrières (population = 3 160). En termes d’espérance de santé, l’écart s’étend de 6 à 8 ans entre ces deux groupes, à l’avantage de Pont-Rouge.

Conclusion : Même si la mesure des inégalités de santé à l’échelle locale en milieu rural pose certains problèmes, de vraies disparités existent dans le comté de Portneuf, et celles-ci demandent maintenant à être examinées plus à fond.

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