In the late 1990s, an area-based material and social deprivation index was developed for Québec. Later, by 2007 and 2008, it was extended to cover the whole of Canada. The initial goal of the index was to overcome the absence of socio-economic information in health administrative databases and to describe, using these databases, the existence and magnitude of social inequalities in health. The index was originally developed and further expanded by researchers from Québec’s Ministry of Health and Social Services and Institute of Public Health. For them, the index had to be relevant for public health research, planning and intervention.

Over the past decade, the index has been used extensively in Québec and Canada. Our intention here is to provide an overview by describing its construction and numerous uses. First, the concept, methods and products related to the index are presented. Second, adaptation of the index to users’ needs is emphasized. Third, uptake and use of the index are reviewed. Finally, the advantages and limitations of the index, as well as associated ongoing projects, are outlined; a short conclusion follows.

The index concept, methods and related products

The conceptual underpinnings of the deprivation index originate with the ideas of Peter Townsend, who conceived of deprivation as “a state of observable and demonstrable disadvantage relative to local community or the wider society or nation to which the individual, family or group belongs”. For Townsend, deprivation comprises two dimensions: material and social. While the former has to do with lack of access to everyday goods and amenities (e.g., proper housing, a car or television), the latter expresses the fragility of social networks, from family to community.

Data were drawn from the Canadian censuses of 1991, 1996, 2001 and 2006, and cover virtually the entire population of Québec and Canada (>98% of individuals living in private households). The unit of observation is geographic and corresponds to the smallest statistical area for which census data are available. This unit was the enumeration area (EA) in 1991 and 1996, and the dissemination area (DA) in 2001 and 2006, areas that comprise an average of 400 to 700 individuals.

On the basis of these areas, six socio-economic indicators were selected for their known relations with health and their affinities with the two dimensions of deprivation, material and social: the proportion of persons without a high school diploma; the employment-population ratio; the average personal income; the proportion of persons living alone; the proportion of individuals separated, divorced or widowed; and the proportion of single-parent families. All of them concerned people aged 15 or over and, with the exception of the last indicator, have been adjusted according to
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Table 1. Indicators and Components of the Index of Material and Social Deprivation, Canada, 2006

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Component</th>
<th>Material</th>
<th>Social</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persons without high school diploma</td>
<td></td>
<td>-0.82</td>
<td>0.03</td>
</tr>
<tr>
<td>Ratio employment/population</td>
<td></td>
<td>0.70</td>
<td>-0.15</td>
</tr>
<tr>
<td>Average personal income</td>
<td></td>
<td>0.81</td>
<td>-0.30</td>
</tr>
<tr>
<td>Persons living alone</td>
<td></td>
<td>-0.02</td>
<td>0.84</td>
</tr>
<tr>
<td>Persons separated, divorced or widowed</td>
<td></td>
<td>-0.18</td>
<td>0.88</td>
</tr>
<tr>
<td>Single-parent families</td>
<td></td>
<td>-0.28</td>
<td>0.63</td>
</tr>
<tr>
<td>Explained variance</td>
<td></td>
<td>32%</td>
<td>33%</td>
</tr>
<tr>
<td>Cumulated variance</td>
<td></td>
<td>32%</td>
<td>65%</td>
</tr>
</tbody>
</table>

Note: Values in this table are loadings. They can be interpreted as correlation coefficients between indicators and components. Source: Canadian Census, 2006.

The age and sex structure of the Canadian population. To create the index, the indicators were submitted to a principal component analysis (PCA) in order to summarize the available information. For Canada as a whole, the PCA extracted two main components, the first grouping indicators of education, employment and income (hereafter the material component), the second combining indicators related to marital status and family structure (hereafter the social component) (Table 1). The same two components were also found for every Canadian region and geographic area in every census year. These results are coherent with Townsend’s proposal of a bidimensional structure for deprivation and reveal a high level of spatial and temporal stability for this structure in Québec and Canada.

The PCA produced a value (factor score) indicating the level of deprivation in every small area unit (EA or DA). A value was produced for each dimension of deprivation, material and social. With this value, it is possible to classify all small areas in Canada, along with any regional or local entities, in population-weighted quintiles (i.e., groups of 20%) ranging from the least deprived (first quintile or Q1) to the most deprived (fifth quintile or Q5) and to consider each dimension of deprivation either separately or jointly (Figure 1).

A deprivation index was produced for several census years (1991, 1996, 2001, 2006) and on different scales: Canada as a whole; Canadian regions; the census metropolitan areas (CMAs) of Toronto, Montreal and Vancouver, and other Canadian CMAs; and the metropolitan influenced zones. In the province of Québec, versions of the index are also available by health administrative region, health and social services centres (CSSS) and local community services centres (CLSC). These versions are meant to depict social inequalities within specific areas. Products related to the index (interactive maps, assignment program, population tables and methodological guides) are available online and free of charge.6-8

Adapting the index to user needs
It appeared very early on that making the index available online and free of charge was not enough. More had to be done to adapt the index to the needs and context of potential users. This is why regional and local versions of the index were produced for Québec.6-8 and simplified maps and statistical analyses combining both forms of deprivation were generated to examine health inequalities in 15 metropolitan areas of Canada.9

In the early 2000s, a deprivation evaluation system for local communities and CLSC clienteles was elaborated in partnership with these organizations.10,11 CLSCs provide basic health and social services at the local level in Québec (e.g., medical consultations, home care for the elderly, psychosocial services). Meetings were held with stakeholders from seven CLSCs to define the content and structure of the system in order to take the needs of CLSCs into account. On this basis, a website was launched in 2004, providing each CLSC of Québec (N=145) with a set of tools for tracking how local services reach the most deprived groups.12 The website provides local decision-makers with information about relative inequalities in service delivery in the form of a table summarizing the extent of inequalities, in terms of both the number of individual users and the total volume of interventions (Figure 2). Meetings with local decision-makers proved that such information is considered useful for determining the extent to which priority is given to deprived groups. Other features help local stakeholders interpret the results: interactive maps, local population distribution across deprivation levels, a list of other CLSCs that are comparable in terms of deprivation, and an interpretation framework. The framework suggests a set of explanatory factors, put together in consultation with local stakeholders, to account for inequalities in service delivery.

Thus, over the years, the deprivation index has been adapted to the needs of various users and, in return, these users have contributed to a better understanding of the advantages and limitations of the index.

Uptake and use of the index
Since its creation, the index has been used extensively in the field of health and social services, mainly in Québec but also at the regional and national level in the rest of Canada. The many uses of the index can be categorized into four types, all related to public health: describing geographic variations in deprivation, illustrating inequalities in population health status and service use according to deprivation, supporting the development of health reports and policies, and guiding regional resource allocation.

One major concern for health authorities, whether at the national, regional or local level, is to be aware of variations in deprivation over their area and to localize the most vulnerable groups. To this end, visual analyses of deprivation maps available online offer a first take.9 Regional analyses of deprivation have also been con-
ducted for the health sector of Québec. In some cases, the deprivation index has been used to define local communities or neighbourhood units. Furthermore, maps and statistical profiles of deprivation are often the first step of projects whose main aim is to look at inequalities in health, both in Québec and Canada. These analyses reveal simple spatial trends in deprivation. While outlying regions show high levels of material deprivation, urban and metropolitan centres are characterized by a greater heterogeneity, with areas where high levels (downtown) or low levels (in the suburbs) of both material and social deprivation are clustered.

The deprivation index is useful for describing inequalities in terms of population health status or health service use in Québec and Canada. Associations have been found with various global measures of health, including life expectancy and health expectancy at birth and at different ages in Québec, differences in health expectancy at birth between the most and the least materially and socially deprived quintiles are 10 years among men and 7 years among women. Associations have also been found between the index and other measures, such as disability, incidence and prevalence of several diseases, self-declared health and certain risk or protective factors for health (vaccination against influenza, low birth weight, smoking, overweight, food insecurity and sedentary lifestyle). Social issues have also been linked to the index, notably teenage fertility and child maltreatment. Last, strong associations have been found between the index and health service use, including medical and dental consultations, eye tests and services provided in hospitals, day surgery clinics, long-term care facilities and CLSCs.

Table 2. Health Expectancy* in Years and 95% Confidence Intervals (CI), by Deprivation Quintile and Sex, Québec, 2000-2002

<table>
<thead>
<tr>
<th>Deprivation Quintile</th>
<th>Men Health Expectancy</th>
<th>Women Health Expectancy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Years CI</td>
<td>Years CI</td>
</tr>
<tr>
<td>Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>72.5</td>
<td>75.7</td>
</tr>
<tr>
<td>2</td>
<td>71.0</td>
<td>75.1</td>
</tr>
<tr>
<td>3</td>
<td>69.0</td>
<td>73.6</td>
</tr>
<tr>
<td>4</td>
<td>69.0</td>
<td>72.7</td>
</tr>
<tr>
<td>5</td>
<td>67.0</td>
<td>72.6</td>
</tr>
<tr>
<td>Social</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>71.1</td>
<td>73.7</td>
</tr>
<tr>
<td>2</td>
<td>70.9</td>
<td>73.2</td>
</tr>
<tr>
<td>3</td>
<td>69.5</td>
<td>73.6</td>
</tr>
<tr>
<td>4</td>
<td>69.3</td>
<td>73.4</td>
</tr>
<tr>
<td>5</td>
<td>67.4</td>
<td>72.0</td>
</tr>
<tr>
<td>Material &amp; Social</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 &amp; 1</td>
<td>74.3</td>
<td>75.2</td>
</tr>
<tr>
<td>S &amp; 5</td>
<td>64.2</td>
<td>69.4</td>
</tr>
<tr>
<td>Quebec</td>
<td>69.6</td>
<td>73.3</td>
</tr>
</tbody>
</table>

* Health expectancy is a global measure of population health status, combining mortality and morbidity. It is based on loss of functional health (Health Utilities Index) in eight attributes: vision, hearing, speech, ambulation, dexterity, emotion, cognition and pain. In the present calculations, health functional values noted for people living at home and for people in institutions have been applied to their respective population.
These analyses suggest that an increase in deprivation is associated with a decrease in health and an increase in health care use, at the population level. Such a relation, however, might go the other way for some health professionals and services. In Québec, for instance, dental consultations and eyes tests among children (which are free) are less frequent in the most deprived groups. Also, temporal analyses conducted in Québec, Nova Scotia and Edmonton, suggest that inequalities in health status are widening. Finally, most analyses using the index have found that both forms of deprivation, material and social, can have an independent impact on population health status and health care use.

The relations between deprivation and health issues in Québec have led the Ministry of Health and Social Services (MSSS) to use the index in preparing public health reports and policies. Examples are the Québec Chief Public Health Officer’s report on the health and well-being of young people living in poverty and the Québec plan for monitoring health and its determinants. MSSS also introduced the index in its regional resource allocation method and its regional and local planning scheme for the medical workforce. For regional resource allocation, several client-oriented programs use the index as a measure of population needs: general health and social services (provided by CLSCs); physical health (short-term hospitalizations, day surgeries and emergency services); public health; and mental health and services to young people with social adjustment problems. Finally, in Québec, the index has been used outside the field of health and social services for targeting vulnerable areas or populations and allocating financial resources. Ministries and public organizations have drawn on the index to support urban renewal, local development initiatives, programs for the unemployed, the creation of new places for day nurseries, and emergency planning.

The index advantages and limitations
Since its creation a decade ago, the deprivation index has been widely tested in the field of public health and beyond. Its bi-dimensional structure – material and social – has been found to apply everywhere in Canada, between 1991 and 2006. Strong relations between the index and various health and social issues have been documented, and these have supported health planning and interventions at the provincial, regional and local level in Québec. Many researchers and decision-makers now recognize the clarity and the usefulness of the deprivation index.
However, two index limitations should be mentioned. First, the index does not constitute an explanatory framework for social inequalities in health. In fact, it incorporates six indicators drawn from national censuses and ignores certain social issues. Indicators of immigration (which is related to ethnicity) and aboriginality were not included in the index as they do not discriminate between local areas, except in some specific settings (e.g., immigrants in major urban centres or native groups in the remote hinterland). Immigration and aboriginality are also associated with mortality and survival above and beyond deprivation. Such associations thus ought to be considered in combination with the index in order to obtain a more complete picture of the social inequalities in health corresponding to specific settings within Canada. No indicator of residential mobility (change of home or place of residence) was included in the index, but analyses carried out in Québec revealed that residential mobility is highly and positively correlated with the social dimension of the index and is therefore part of it, though not explicitly considered. Investigating further the impact of residential mobility on health inequalities at a local level is desirable and would require longitudinal analyses.

Second, the index is not an individual-level measure but, rather, a small-area measure of socio-economic conditions and, as such, it underestimates the magnitude of social inequalities in health, especially outside major urban centres. Conversely, above and beyond residents’ characteristics (compositional effects), the index accounts for territorial realities (contextual effects) also related to health inequalities. Studies reveal that our area-based deprivation index remains an explanatory factor for health issues, namely mortality, disability and survival, even when individual attributes are accounted for.

The material and social deprivation index is a marker of social inequalities in health. It is a proxy for many individual and contextual determinants of population health and, as such, it can be used to monitor social inequalities in health over time and space, in Québec and Canada.

Ongoing projects
Several projects are under way to further explore the characteristics and usefulness of the deprivation index in Québec. One project is based on the hypothesis that residential mobility might be responsible for the recent widening of social inequalities in health in Québec. A second project is reviewing the existing deprivation evaluation system for local communities and CLSC clientele to make it fit with the responsibilities and jurisdiction of a new administrative entity, the CSSS, in charge of delivering services at a local level in Québec. Nine CSSSs are closely associated with this operation. The last project seeks to develop strategies and indicators for monitoring social inequalities in health in Québec in partnership with the Québec surveillance board, which is made up of surveillance professionals from the province’s 18 health administrative regions, the Ministry of Health and Social Services and the Québec Institute of Public Health.

CONCLUSION
These ongoing projects show how the development and use of the deprivation index is the result of a close partnership between producers and users. The authors are currently collaborating with researchers and health authorities on other projects in Québec and elsewhere in Canada. All are partners and can be considered as “co-authors” of the index, as they have helped (and continue to help) adapt it for various needs by providing precious insight into different professional contexts and settings. This form of partnership is also valuable for intervention as everyone holds a “key” for reducing social inequalities in health.

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AN ABSE INDEX FOR PUBLIC HEALTH IN QUÉBEC AND CANADA


