Decentralisation in health care and equity in health: a descriptive approach applied to Canada

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Abstract

A substantial amount of literature in the health care sector has emphasised the role of decentralisation in reducing health inequalities, improving access for the poor, and equity in resource allocation. This contrasts with the lack of empirical research that has sought to confirm these theoretical arguments. Moreover, the existing research on the issue is not very adequate for two main reasons. Firstly, because it only investigates overall or inter-jurisdictional inequalities or inequities in health, ignoring the intra-jurisdictional dimension of equity. Secondly, studies on this area usually employ very simple statistical tools to evaluate health inequalities. Generally, they compare the evolution of per capita expenditures in health care or health utilisation across regions grouped by income levels once decentralisation has taken place.

We overcome the pitfalls of current studies on decentralisation and health care by using a superior measure to evaluate health inequalities -the Concentration Index- and by focusing on the overall, between and within geographical dimensions of equity in health following a decomposition technique originally developed by Rao (1969). The decomposition exercise is applied to Canadian data taken from the 2001 *Canadian Community and Health Survey*, a detailed survey on health status and health care utilisation both at the provincial and sub-provincial (regional) levels of analysis. Using this data we measure the contribution of income-related health inequalities and inequities between and within provinces and regions to overall health inequalities/inequities in Canada. The methodology employed provides insights into the spatial nature of inequality and inequity that may be of interest to policy makers in highly decentralised contexts such as the Canadian one.

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Contents

1 Introduction

Most studies about decentralisation and equity in health have been based in analysis of the range. For instance, Bossert et al. (2003) examine the evolution of national and local per capita expenditure and utilisation by municipal income deciles after decentralisation was implemented in Chile and Colombia. Similarly, Habibi et al. (2001) analyse the gaps in the evolution of health expenditures in high and low income Argentinean provinces during the period 1970-1994. West and Wong (1995) examine the disparities across Chinese provinces in the provision of health services in the early nineties. A few other studies have used the Concentration Index (CI) to evaluate post-decentralisation inequities and inequalities in health (e.g, Hjortsberg CA and Mwikisia CN, 2002).

In this study we measure income-related inequities in health and in health care use in a well known decentralised country -Canada- by using the Concentration Index. The CI is considered as one of the best measures of inequality [Wagstaff et al. (1991)]. On the one hand the CI reflects the experience of the entire population rather than that of two extreme groups on the socioeconomic scale (which is what e.g. the range measures). On the other hand, the CI incorporates the socioeconomic dimension of inequality in health, is sensitive to changes in the population across socioeconomic groups, and to the size of the socioeconomic groups.

We decompose the overall CI into a between and a within socioeconomic status (SES) group inequality/inequity in health/health care use. In this way we take account of the multidimensional nature of equity usually ignored in the literature on decentralisation and equity in health. The statistical techniques behind the CI decomposition were originally developed by Rao (1969), and recently used in the health literature by Clarke et al. (2002) and Wagstaff and

Van Doorslaer (2003). We depart from these studies by:

- decomposing not only inequalities in health but also inequities in health care use;
- defining the decomposition groups on a geographical basis rather than on a SES basis;
- and by reporting standard errors for the various CI.

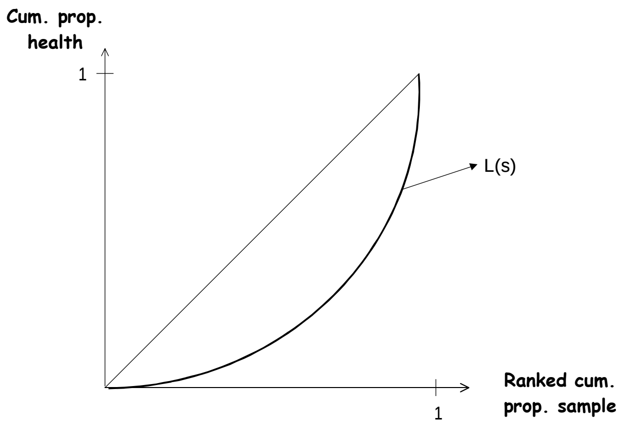
This paper is organised into four sections. Section one introduces the methodology that will serve as the basis for the analysis. Section two describes the data and the main variables used in the statistical estimations. Section three presents some preliminary results obtained by applying Rao's proposed statistical techniques to Canadian provinces and regions. Finally, section four concludes with a discussion of the empirical results obtained for the Canadian data.

2 Methodology

2.1 Decomposition of the Concentration Index

The CI is a measure of the relative socioeconomic status-related inequality. It is based on the Concentration curve $[L(s)]$, a cumulative frequency curve that compares the distribution of a certain variable with the uniform distribution that represents equality. This equality distribution is shown by the diagonal line, and the greater the distance between the L(s) and this line, the greater the inequality. When applying the CI to health data, the proportion of the population ranked by SES is usually represented on the X axis, and the cumulative proportion of the health variable on the Y axis. The CI is twice the area between the L(s) and the diagonal, and ranges between -1 and +1. The convention is that the index takes a negative value when L(s) lies above the line of equality -inequality favouring low SES individuals- and a positive value when it lies below the line of equality -inequality favouring high SES individuals-. When the health variable is a "bad" (e.g., ill-health), negative values of the CI are associated to pro-rich inequalities, and positive values are associated to pro-poor inequalities.

Figure 1: Concentration Curve



By analogy with the decomposition of the Gini coefficient (Lambert PJ and Aronson JR, 1993) it is possible to divide the CI into the following components:

$$CI = CI_B + CI_W + R \quad (1)$$

where:

CI : Overall CI calculated on the full sample. It can be computed on the basis of the following "*convenient covariance*" formula:

$$CI = \frac{2}{\mu} Cov\left(h_i, R_i\right) \quad (2)$$

where:

μ: mean health

h_i: health of individual i

R_i: individual i's fractional rank in the SES distribution

This points at a very convenient way of estimating the CI (and its standard error) as the coefficient β in the regression equation[1] (Kakwani et al. 1997):

$$2 * \sigma_R^2 \left[\frac{h_i}{\mu}\right] = \alpha + \beta R_i + {\varepsilon_i}^2 \quad (3)$$

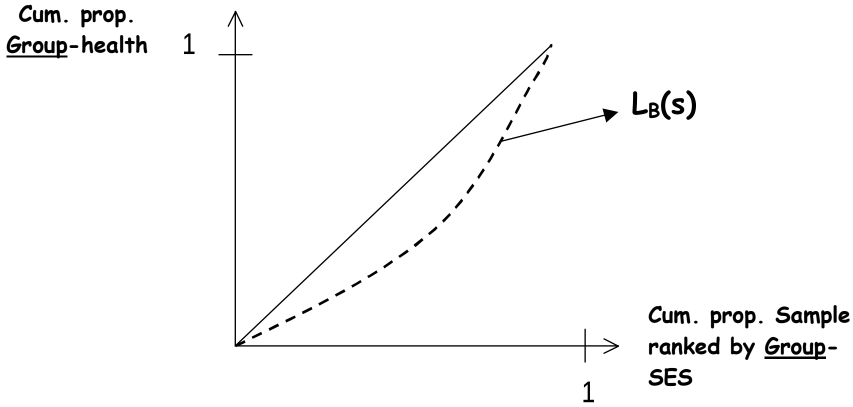
[1] In the regression equation:

$h_i = \alpha + \beta R_i + \varepsilon_i$
$\hat{\beta} = \frac{Cov\left(h_i, R_i\right)}{\sigma_R^2}$
By multiplying the right hand side of the equation by $2 * \sigma_R^2$ and dividing it by μ we get that:
$\hat{\beta} = 2 * \left(\frac{Cov\left(h_i, R_i\right)}{\sigma_R^2} * \frac{\sigma_R^2}{\mu}\right) = \frac{2}{\mu} Cov\left(h_i, R_i\right) = CI$

[2] The autocorrelation induced by the ordinal nature of the rank can be taken into account by using the Newey-West estimator.

$\mathbf{CI}_B$: Between-group CI. An estimate of the CI_B (and its standard error) can be calculated using the previous "*convenient regression*" but replacing individual health with the mean health group and sorting groups by ascending order of the SES variable to compute the rank. This is illustrated in figure 2 .

Figure 2: Between groups concentration curve



$\mathbf{CI}_W$: Within-group CI. It is calculated as the weighted product of the CI of the J groups:

$$CI_W = \sum_{j=1}^{J} w_j p_j CI_j \tag{4}$$

where:

w_j : health share of the j-th group

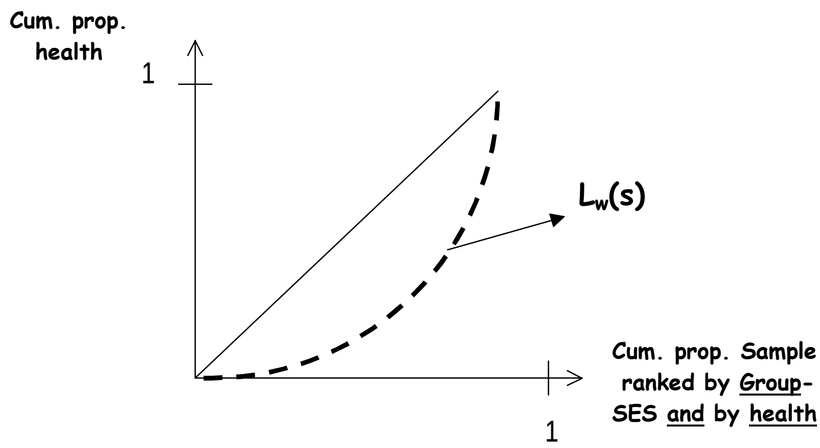
p_j : population share of the j-th group

CI_j : CI of the j-th group

CI_j and its standard errors are estimated by convenient regression equations on the j-th group sample. Graphically, the CI_W is given by the area between

$L_B(s)$ and the concentration curve resulting from keeping the J groups arranged in ascending order of the SES variable but allowing for within-group variation in health $[L_W(s)]$. $L_W(s)$ will therefore lie underneath $L_B(s)$ as shown in figure 4.

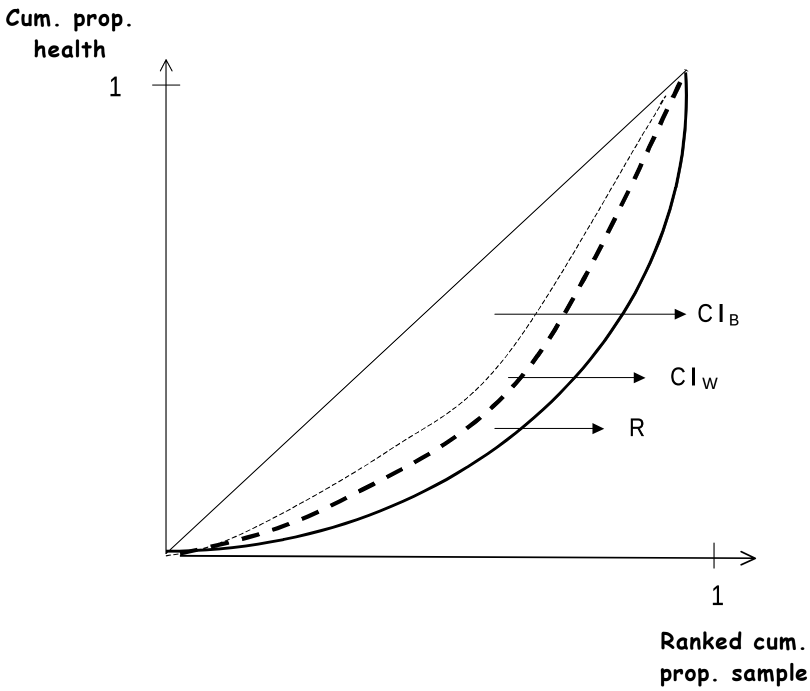
Figure 3: Between and within groups concentration curve



R = residual term that takes on a non-zero value when the SES ranges overlap, i.e. if the higher SES individuals in group 1 have a greater SES than the lower SES individuals in group 2 and so on. Given that overlappings are common, $L(s)$ is expected to differ from $L_W(s)$. R will be positive if as it is likely health is positively correlated with the SES variable. Therefore, $L(s)$ is expected to lie further from the line of equality than $L_W(s)$.

The CI is not perfecly decomposable by groups as the residual R will always arise when the SES ranges of the various groups overlap. While perfectly decomposable univariate measures of inequality such as the Theil index are available, to date no perfectly decomposable bivariate measures of inequality have been

Figure 4: Graphical representation of CI_B, CI_W and R



developed in the literature. We accept this lack of neatness as the unavoidable cost of incorporating the socioeconomic dimension into the distribution of the health variable. Reducing income related health inequalities is one of the key policy objectives of many health systems.

2.2 Estimation procedures

2.2.1 Health inequalities

The methodology presented in the previous subsection can be straightforwardly applied to decompose total income-related health inequalities into between and withing groups income-related inequalities in health. We use the mean income of each province/health region of Canada as the SES variable. As for the health status, we use the mean health of each province and region of Canada, together with individual-level data on health (required for the calculation of within groups health inequalities). A description of the health data as well as the other non-health data employed in the estimations is provided in the following section. CI, CI_W and CI_B are derived on the basis of "*convenient regressions*" on individual or grouped data. Using this methodology we derive standard errors for the CI, the CI_B and the CI of each individual province/health region in Canada. We use the "*convenient covariance*" approach to double-check the results [3]. R is computed as the difference between CI and the sum of CI_B and CI_W. Individual weights (provided by the Canadian Community and Health Survey) were applied in all computations in order to make the results more representative of the Canadian population. In addition, in order to avoid sampling error, we excluded from the analysis the three Canadian territories -Yukon, Northwest territories, Nunavut- and restricted our attention to the ten Canadian provinces -Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia-.

[3] The "*convenient covariance*" is given by:

$$CI = \frac{2}{\mu} Cov(y_i, R_i)$$

where:
y_i =health variable
μ =mean of the health variable
R_i = individual, provincial or regional rank in the income distribution
Using Stata, we first calculate the fractional rank in the distribution of income -*glcurve*-. Once we have the rank, we can calculate the mean of the health variable, and the (weighted) covariance between it and the fractional rank variable -*cor*-.

2.2.2 Inequities in health care use

Following the literature in this field, we have focused our study to the analysis of *horizontal inequities* in the use of health care [4]. Therefore we seek to answer the question of whether individuals with the same needs to use health services are treated equally, irrespective of other non-need characteristics. If use varies with non-need characteristics, then there is horizontal inequity. The starting point is to calculate the *need*-standardised use for health care. We have used a regression based-approach to standardise access for need in an indirect way.

The *indirect standardisation* (IS) compares the actual distribution of use with that expected on the basis of needs. In the case of linear regressions IS is calculated according to the following formula:

$$\hat{Y}_i^{IS} = Y_i - \hat{Y}_i^X + Y^m \tag{5}$$

where:

Y_i : actual utilisation

Y^m : sample mean

$\hat{Y}_i^X$: need (x) expected utilisation. It is calculated in two steps:

1. Regress medical care use (Y_i) on three types of explanatory variables: income, a vector of k need indicator variables (x_k), and a set of p non-need variables (z_p):

$$Y_i = \alpha + \beta inc_i + \sum_k \gamma_k x_{k,i} + \sum_p \delta_p z_{p,i} + \varepsilon_i \tag{6}$$

2. Combine coefficients of the OLS estimations with actual values of the

[4] *Vertical equity* in utilisation involves a test of whether utilisation varies according to the factors that ought to affect use. Vertical equity is not commonly studied in the literature, as it requires strong judgements about the size of the coefficients of the need variables.

x_k variables and sample means of the income and z_p variables:

$$\hat{Y}_i^X = \hat{\alpha} + \hat{\beta} inc_i^m + \sum_k \hat{\gamma}_k x_{k,i} \ + \sum_p \hat{\delta}_p z_{p,i}^m \qquad (7)$$

$\hat{Y}_i^X$ indicates the amount of medical care an individual would have received if he had been treated as others with the same need characteristics, on average.

Once inequities in the use of health services have been obtained, we can decompose them into provincial and regional income-related inequities in health care with the same techniques described above for health inequalities. Sampling weights were also applied throughout.

Despite the discrete nature of the health care use variables, we have relied upon simple OLS estimation techniques in the first instance, since there is some evidence that the results of the standardisation using OLS and non-linear techniques do not considerably differ (Van Doorslaer et al., 2000). However, we plan to consider appropriate non-linear models (e.g. two part models) for the econometric estimations in the future.

3 Data and variables

Our data for Canada is taken from the 2001 *Canadian Community and Health Survey (CCHS)*, the first wave of a nationally representative health survey of individuals aged twelve years and over living in Canada[5]. The CCHS has an optimal design to carry out this study because of the detailed data on health status and health care utilisation it provides both at the provincial and the regional levels of analysis, and because of its large sample size (130.880 respondents). Using this data, we attempt to measure the contribution of income-related inequalities in health/inequities in health care use between and within provinces and regions to overall income related inequalities in health/inequities in health care in Canada[6]. The following subsections specify the variables used in the decomposition analysis distinguishing between data employed for the calculation of inequalities in health and data employed for the calculation of inequities in health care use.

3.1 Health inequalities

Health status

We have measured health status using the *Mc Master Health Utility Index* (HUI). The HUI provides a comprehensive description of an individual's overall functional health on the basis of eight attributes: vision, hearing, speech, ambulation (ability to get around), dexterity (use of hands and fingers), cognition (memory and thinking), emotion (feelings), and pain and discomfort. It assigns

[5] The CCHS has taken over the cross-sectional component of the National Population Health Survey (NPHS) that in 2000/01 became a longitudinal survey. However, the CCHS produces health regions cross-sectional estimates in addition to information at the provincial level of aggregation.

[6] The organisation of health care services in Canada has traditionally remained under provincial control. However during the nineties, certain major responsibilities in the health care sector like hospitals have been devolved to the regions. Physician services and drugs are the two main exceptions. Currently there are 10 provinces (plus 3 territories with a special status) and 136 health regions in Canada.

a single numerical value, between -0.360 and 1, for all possible combinations of levels of these attributes. A score of 1 indicates perfect health, while a score of 0 indicates death. Negative scores indicate health status considered worse than death. In order to have a positive measure of health for the calculation of the Concentration Index, we have rescaled the HUI to the $(0, 1)$ interval using the following formula:

$$y^b = \frac{y^a - y^{\min}}{y^{\max} - y^{\min}}$$

where:

y^b : rescaled HUI values

y^a : original HUI values

$y^{\min}$: smallest individual HUI value

$y^{\max}$: largest individual HUI value

As opposed to the widely used self assessed health (SAH) variable, the alternative health status indicator in the CCHS, the HUI has a continuous nature and can therefore be used straightforwardly to evaluate inequalities with standard techniques such as the Concentration Index[7]. In addition, the HUI can be considered as a more objective measure of health status than the SAH, as respondents are asked to classify themselves into eight health categories instead of directly reporting their own level of health. By using weights based on the general population rather than on the individual's own valuations, the various health dimensions are added together into a single utility score. The HUI is

[7] Categorical health related variables create a problem for the measurement of inequalities in health. This is due to the fact that most inequality measures (variance, Concentration Index, Gini Coefficient, the Theil index, etc) depend on the mean and the mean is sensitive to the scale used to convert the categorical variable into a numerical one (Allison and Foster, 2004).

SAH has often been transformed into a continuous or dichotomous variable on the basis of different methods. Van Doorslaer and Jones (2003) provide a detailed review of this literature as well as a new methodology using more developed techniques.

therefore less likely to suffer from systematic reporting bias on the basis of individual characteristics such as income or social class[8] (Humphries and Van Doorslaer, 2000).

Income

Income is measured by means of a continuous variable that provides an estimate of the aggregate income, before taxes and deductions, of all household members from all sources during the twelve months previous to the survey. Household income is equivalised to take into account differences in the size and composition of the families. Clearly, the disposable income of a four-person family is not comparable with that of a single individual. The equivalence scale we use is the modified OECD scale:

$$\text{equivalent income} = \frac{\text{income}}{1+0.5*(\text{household size}-1-\text{number of children})+0.3*\text{children}}$$

This equivalence scale assigns a weight of 1.0 to the first adult household member, 0.5 to the second adult household member, and 0.3 to children[9]. Accordingly, a four-person household with two adults and two children would only need an income 2.1 times greater than that of a single person household to have an equivalent income. Although the modified OECD scale is one of the most frequently used scales to equivalise income, it is not yet clear from the literature which formula is best. Alternative rescaling formulas include the square root of the household size [Wagstaff et al.(2001),Van Doorslaer and Jones(2003)], or the square root of the sum of the number of adults with a weight of one and the number of children with a weight of 0.5 [Gravelle and Sutton(2001)] .

[8] Using Canadian data for 1994 Humphries and Van Doorslaer (2000) show that lower income groups tend to report lower health (in terms of SAH), for the same level of health (in terms of the HUI). They conclude that if HUI can be considered as a more objective measure of health, then subjective measures are likely to overestimate true inequality.

[9] The original OECD scale assigns a weight of 1.0 to the first household member, a weight of 0.7 to the second household member, and a weight of 0.5 to children. As compared to this scale, the modified OECD scale puts more emphasis on the economies of scale within larger households.

Once missing values are excluded our sample for the analysis of inequalities in health is left with 98.480 observations.

3.2 Inequities in health care use

Health care utilisation

In this paper we have only decomposed income related inequities in the use of general practitioner (GP) services. However, we also intend to decompose the income related inequities in the use of specialist visits and hospital care utilisation in Canada. Measurement of the utilisation of GP is based on the question: "*During the past 12 months, about how many times have you seen or talked on the phone about your physical, emotional or mental health with a family doctor or general practitioner?".* 21% of the respondents had no consultations during this period, 78,4% had between one and thirty consultations, and the remaining 0.6% had more than thirty consultations. On the basis of this measure we have constructed a dummy variable taking a value of 1 if the individual had one or more contacts with the GP during the period considered. We use the dumy variable to decompose income related inequities in the probability to contact a GP.

Need variables

The need variables used in our analysis are: age, sex, self-assessed health and health limitations. Age is captured by the following five dummy variables: 12-34, 35-44, 45-64, 65-74, and more than 75 years old. We allow for interaction between age and sex. 12-34 year old male individuals are the reference category. The measurement of health as a proxy for health care need is based on two types of questions in the CCHS. The first one refers to the self-perceived health status of an individual: "I*n general, would you say your health is: Excellent,* *very good, good, fair, poor*?". Based on these five categories, we construct four dummy variables, keeping very good health as the reference category. The second health related question is: "*Are you limited in your* daily activities by mental or physical health problems?" (sometimes, often, never). We create two dummy variables for the variable health limitation. No health problem in daily activities is used as the baseline category.

Non-need variables

The non-need variables used in our study are: province of residence, activity status and education. We include a dummy variable for each of the provinces of Canada, except for our base category: Ontario. For education, we use four levels: less than secondary school graduation, secondary school graduation, some post-secondary studies and post-secondary graduation (reference category). Occupation is captured by six dummy variables derived from different variables that describe the activity status of the respondents: employed (base category), self-employed, inactive, retired, unemployed and student.

Excluding cases with missing values left our sample with 98.286 observations for the analysis of the consultations with the GP and 77.960 for the analysis of the conditional number of consultations with the GP.

4 Results

4.1 Health inequalities

In the following table we present the results of the decomposition of income related inequalities in the HUI in Canada:

Table 1: Income-related inequalities in health, Canada*

Health Utility Index		
CI	0.017 [39.23]	
n	98480	
	Provinces	Regions
CI_B	-0.0032 [-87.59]	-0.0002 [-5.05]
CI_W	0.0043	0.0004
R	0.0159	0.0168
J	10	133

* Newey West based t statistics in squared brackets

These results reveal a significantly pro-rich distribution of HUI among individuals in Canada. However, are these income related inequalities in health due to richer provinces/regions in Canada being more likely to have healthier individuals or to richer individuals within provinces/regions more likely to be healthier than poorer individuals? The decomposition results suggest that the lower level of health status among the poor is due to a combination of within-province/region inequalities and inequality associated to the overlapping of the provinces/regions' income ranges. The positive R indicates that the richest individuals in the poorest areas that overlap with the poorest individuals from the richest areas have comparatively better levels of health.The distribution of HUI across provinces/regions is, by contrast, significantly pro-poor.

4.2 Inequities in health care

Visits to the GP

Table 2: Income-related inequity in visits to the GP, Canada*

Total number of GP visits		
CI	-0.0217 [-4.05]	
n	98286	
	Provinces	Regions
CIB	0.0439 [109.16]	0.0367 [85.8]
CIW	-0.0059	-0.001
R	-0.0596	-0.0574
J	10	133
Dummy for GP visits		
CI	0.0145 [10.23]	
n	98286	
	Provinces	Regions
CIB	0.0139 [102.65]	0.0191 [139.68]
CIW	0.0030	0.0003
R	-0.0023	-0.0048
J	10	133
Conditional number of GP visits		
CI	-0.0344 [-6.69]	
n	77960	
	Provinces	Regions
CIB	0.0274 [73.71]	0.0206 [52.35]
CIW	-0.0086	-0.0012
R	-0.0533	-0.0538
J	10	133

* Newey West based t statistics in squared brackets

The previous table illustrates the decomposition of income related inequities in visits to the GP. There are three different sets of results for each of the income groups analysed (provinces, regions) corresponding to the three OLS estimation techniques employed in standardising visits to the GP on the basis of need. According to these results, the poor seem to use more GP services than the rich even after need differences have been taken into account (CI of the standardised distribution of visits to GP significantly negative). The probability of contacting a GP is however significantly pro-rich. In consequence, most of the pro-poor distributional pattern in visits to the GP should be generated by a pro-poor conditional use. This is verified in the results of table 2 that show a significantly negative CI of the standardised distribution of the conditional use of GP. So although the richer individuals in Canada are more likely to contact a GP than the poorer ones, once they gain access, the poor individuals tend to consult more frequently.

The results of the decomposition indicate that the pro-poor distribution of visits to the GP is attributable to a mixture of within provinces/regions pro-poor inequities and the overlapping term. Within provinces/regions, poor individuals tend to visit more the GP than richer individuals. Again, the likelihood of contacting a GP within provinces/regions is pro-rich, suggesting that the pro-poor distribution of visits to the GP within provinces/regions is caused by a pro-poor conditional use. This is borne out by the results that show a significantly negative CI for the standardised distribution of the conditional use of GP.

On the other hand, the distribution of standardised visits to the GP across provinces/regions appear to be significantly pro-rich. Not only the probability to access a GP is higher in richer provinces/regions than in poorer ones, but also the conditional number of GP consultations seems to be higher in richer provinces. The pro-rich probability of contacting a GP across provinces/regions seems to be significantly important in explaining the pro-rich likelihood of contacting a GP across Canadian individuals.

For both the total and the conditional number of visits to the GP, R has a expected negative value. It indicates that the richest individuals in the poorest areas that overlap with the poorest individuals in the richest areas tend to visit the GP less even after need differences have been taken into consideration. The negative value of R for the decomposition of the dumy for GP visits indicates that income and the likelihood to contact a GP are negatively correlated correlated when areas' income ranges overlap: higher income individuals in the poorest areas that overlap with the richest areas have comparatively a lower probability to contact a GP.

5 Conclusions

In this paper we have measured the spatial contribution of inequities and inequalities in total health inequalities and inequities in the access to GP services in Canada. We have employed a statistical methodology that breaks down income related inequalities in health and inequities in the use of GP into a between provinces/regions and a within provinces/regions component. Unfortunately, the decompostion also includes residual term (R) that takes a non-zero value whenever income ranges of the various areas overlap. We accept this lack of neatness in the decomposition of the CI as the unavoidable cost of incorporating the socioeconomic dimension into the distribution of the health variable, given the increasing interest shown by policy makers in reducing income related health inequalities.

We have classified Canadian provinces and regions into income groups to examine the contribution to income related health inequality/inequity of income-related inequality/inequity between and within provinces and regions. According to the preliminary results of the empirical illustration for health inequalities in Canada, the observed pro-rich distribution in health is more likely to be due to differences in health status between rich and poor individuals within provinces/regions rather than to health gaps between rich and poor provinces. This seems to suggest that efforts taken at the central government level in Canada to reduce income related health inequalitites across Canadian citizens are not replicated by the Canadian provinces/regions. With respect to visits to the GP we found that, after controlling for need differences, the rich are more likely to contact a GP than the poor. However, once a GP contact has taken place, there appears to be a higher tendency for the worse-off to use more GP care. By contrast to health inequalities, the contribution of the between component of both the probability of contacting a GP and the conditional number of GP visits is pro-rich.

The results presented in this study are, however, only preliminary. A better understanding of the spatial dimensions of income related health inequality and inequity would require to include in the analysis health services other than GP. In particular, it would be very interesting to explore whether the regional contributions to income related health inequities in hospital access -services that have been devolved to Canadian health regions- differ from those obtained for GP access -services not devolved to health regions-. In addition, further work remains to be done with respect to the econometrical techniques used to standardise access to health services with respect to need. We will deal with these issues in our future research.

References

[1] Allison RA, Foster JE (2004): Measuring health inequality using qualitative data, Journal of Health Economics 23, 505-524.

[2] Bossert TJ, Larranaga O, Giedion U, Arbelaez JJ, Bowser DM (2003): Decentralization and equity from resource allocation: evidence from Colombia and Chile, Bulletin of the World Health Organization, 81 (1).

[3] Clarke PM, Gerdtham U, Connelly LB (2003): A note on the decomposition of the health concentration index, Health Economics 12, 511-16.

[4] Habibi N, Huang C, Miranda D, Murillo V, Ranis G, Sarkar M, Stewart F (2001): Decentralization in Argentina, Center Discussion Paper No. 825, Economic Growth Centre, Yale University (http://www.econ.yale.edu/~egcenter/research.htm).

[5] Hjortsberg CA, Mwikisia CN, (2002): Cost of access to health services in Zambia, Health Policy and Planning, 17 (1), 71-77.

[6] Kakwani N, Wagstaff A, Van Doorslaer E (1997): Socio-economic inequities in health: Measurement, computation and statistical inference. Journal of Econometrics, 1997, 77: p.87-103.

[7] Lambert P (1993): The Distribution and Redistribution of Income: A Mathematical Analysis (3rd edn). Manchester University Press, Manchester.

[8] Lambert PJ, Aronson JR (1993): Inequality Decomposition Analysis and the Gini coefficient revisited, The Economic Journal 103 (420), 1221-1227.

[9] Morris S, Sutton M, Gravelle H (2003): Inequity and inequality in the use of health care in England: an empirical investigation. CHE Technical Paper Series 27, University of York (http://www.york.ac.uk/inst/che/tp27.pdf)

[10] OECD (2004): Income-related inequality in the use of medical care in 21 OECD countries, Working Paper No 14.

[11] Rao V (1969): Two decompositions of concentration ratio, Journal of Royal Statistical Society Series A 132, 418-25.

[12] Van Doorslaer, E, A Wagstaff, H van der Burg, T Christiansen, D De Graeve, I Duchesne, U-G Gerdtham, M Gerfin, J Geurts, L Gross, U Häkkinen, J John, J Klavus, RE Leu, B Nolan, O O'Donnell, C Propper, F Puffer, M Schellhorn, G Sundberg, O Winkelhake (2000): Equity in the delivery of health care in Europe and the US, Journal of Health Economics 19, 5, 553-583

[13] Van Doorslaer E, Jones AM (2003): Inequalities in self-reported health: a validation of a new approach to measurement, Journal of Health Economics 22, 61-87.

[14] Wagstaff A, Pierella P, Van Doorslaer E (1991): On the measurement of inequalities in health, Social Science and Medicine 33 (5), 545-557.

[15] Wagstaff A, Van Doorslaer E (2003): Overall versus socioeconomic health inequality; a measurement framework and two empirical illustrations, forthcoming in Health Economics.

[16] Wagstaff A and van Doorslaer E (2000): Equity in health care finance and delivery, Chapter 34 of the North Holland Handbook of Health Economics (Edited by AJ Culyer and JP Newhouse).

[17] West LA, Wong CP (1995): Fiscal decentralization and growing regional disparities in rural China: some evidence in the provision of social services, Oxford Review of Economic Policy 11 (4), 71-84.

[18] World Bank (2004): Quantitative Techniques for Health Equity Analysis: Technical Notes No 6 (Concentration curve), No 7 (Concentration Index), No 13 (Measuring Inequity in health service delivery) (http://www.worldbank.org/poverty/health/wbact/health_eq.htm).