Causes of Widening Life Expectancy Inequalities in Québec, Canada, 1989-2004

Jessica Adam-Smith, MSc,¹ Sam Harper, PhD,¹ Nathalie Auger, MD, MSc, FRCPC²⁻⁴

ABSTRACT

Objectives: Inequalities in life expectancy between the most and least materially deprived areas in the province of Quebec, Canada are increasing, but the reasons for this trend are unclear. An analysis of which causes of death, in which age groups, are implicated in this trend is necessary to understand it and provide clear targets for intervention.

Methods: We analyzed Québec mortality data for three 4-year periods from 1989-2004. Differences in life expectancy at birth between the most- and least-deprived areas in each period and over time were decomposed by age and cause of death for men and women using the Arriaga method.

Results: Life expectancy increased for all areas, but the increase was smaller in deprived areas. Cancer, heart disease and unintentional injuries accounted for the largest shares of inequality in each period. Among women, the widening life expectancy gap was largely due to increased lung cancer mortality. Among men, mortality from HIV was an important cause of widening inequality. Increasing inequality in both sexes was offset by a decrease in mortality from unintentional injuries in deprived areas (narrowing the gap between the most- and least-deprived areas). The largest share of inequality among women was due to deaths in the 65-and-over age group. Among men, the largest share shifted over time from middle-age to the 65-and-over age group.

Conclusion: The widening life expectancy gap between advantaged and disadvantaged areas in Québec is driven by relatively few causes of death with well-known risk factors and strategies for prevention.

Key words: Life expectancy; health inequalities; deprivation

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

Can J Public Health 2011;102(5):375-81.

There is an increasingly recognized relationship between health and the socio-economic context in which people live. Material deprivation of areas, whether measured for census tracts, neighbourhoods or regions, has been associated with increased mortality, even after adjusting for individual-level socio-economic differences.¹ In the province of Québec, Canada, socio-economic inequalities in health outcomes have been demonstrated at several geographic scales.²⁻⁵ Neighbourhood characteristics may shape social and economic opportunities and health-related behaviours. Socio-economic context may also influence health more directly through stress, psychosocial factors, food availability, crowding or pollution.^{1,6}

Recent studies in several industrialized settings, including Québec, have found that inequalities in life expectancy between affluent and deprived areas have grown.⁷⁻⁹ Understanding which causes of death are contributing to the growth of these inequalities is important for public health initiatives aiming to equitably improve mortality rates.¹⁰ Potential for these initiatives to succeed is enhanced when there are clear targets for intervention. The objective of this study was to evaluate the age- and cause-specific components contributing to trends in life expectancy inequality between the most- and least-deprived areas in Québec.

METHODS

Death information was extracted from vital statistics of the Québec health ministry, which provided age, sex, cause of death, and place

of residence of decedents. We analyzed three periods: 1989-1992, 1995-1998 and 2001-2004. Population counts were obtained from census projections for the central year of each period, adjusted for under-enumeration.¹¹

We ranked areas of Québec into deciles of material deprivation and calculated estimates of life expectancy at birth for each decile and period. Areas of analysis were territories of the Local Community Service Areas (CLSCs). Material deprivation level was based on a widely used composite index developed for Québec.¹² Further details about area classification are indicated in Appendix 1. Life expectancy was calculated using standard life tables¹³ with 20 age groups (<1, 1-4, 5-9....85-89, 90+ years).

Examination of trends in life expectancy revealed that the most striking inequality was present between the most- and least-deprived deciles (Table 1b), and that life expectancy in the least-deprived decile was well above the life expectancy in other deciles in every period. To avoid masking this difference, data were not aggregated into quintiles. Inequality in life expectancy was defined

Author Affiliations

1. Department of Epidemiology, Biostatistics and Occupational Health, McGill University, Montréal, QC

2. Institut national de santé publique du Québec, Montréal, QC

3. Department of Social and Preventive Medicine, Université de Montréal, Montréal, QC

4. Centre de recherche du Centre hospitalier de l'Université de Montréal, Montréal, QC

Correspondence: Jessica Adam-Smith, Department of Epidemiology, Biostatistics and Occupational Health, McGill University, Purvis Hall, 1020 Pine Ave West, Room 17B, Montréal, QC H3A 1A2, Tel: 514-398-5805, Fax: 514-398-4503, E-mail: jessica.adam-smith@mcgill.ca

Conflict of Interest: None to declare.

Table 1a. Descriptive Characteristics of Local Community Service Centres (CLSCs), Québec

	Least Deprived (Decile 1)	Most Deprived (Decile 10)	All Deciles
Population, Male			
1989-1992	340,329	376,361	3,464,734
1995-1998	347,685	381,197	3,575,749
2001-2004	358,817	381,537	3,682,658
Population, Female			
1989-1992	364,761	373,138	3,569,497
1995-1998	374,038	374,833	3,685,014
2001-2004	385,345	373,733	3,781,985
Number of Deaths, Male			
1989-1992	9406	14,239	107,152
1995-1998	9636	14,467	111,919
2001-2004	9758	13,979	111,198
Number of Deaths, Female			
1989-1992	9130	10,351	88,041
1995-1998	10,260	11,625	101,668
2001-2004	11,116	12,233	109,508
Average Population per CLSC			
Mean	62,430	19,326	42,212
Range	31,541-107,905	2540-52,099	1355-133,475
Proportion of Rural CLSCs			
All rural	0	72.2	30.2
Some rural	9.1	13.9	31.5
No rural	90.9	13.9	30.2
Proportion of Aboriginal CLSCs	0	19.4	17.9

Table 1b. Life Expectancy at Birth According to Time Period and CLSC Deprivation Decile, Québec

Decile	Life Expectancy at Birth (years)					
	Males			Females		
	1989-1992	1995-1998	2001-2004	1989-1992	1995-1998	2001-2004
1 (least deprived)	75.9	77.6	79.8	82.4	83.2	84.4
2	74.2	75.4	77.8	81.2	81.2	82.3
3	73.9	75.1	77.2	80.7	80.9	82.0
4	73.1	74.4	76.4	80.3	80.5	81.8
5	74.4	75.7	77.7	81.1	81.3	82.5
6	73.1	74.2	76.5	80.6	81.0	81.9
7	73.2	74.6	76.4	80.5	80.6	81.8
8	72.8	74.0	76.2	80.2	80.9	82.2
9	72.5	73.3	75.6	80.4	80.5	81.3
10 (most deprived)	72.3	73.3	75.6	80.0	80.4	81.4

as the absolute difference between life expectancy of the least- and most-deprived deciles. We used Arriaga's decomposition method to calculate the contribution of age group and cause of death to the change in inequality over time.^{14,15} This method uses differences in all-cause and cause-specific mortality rates within each age group to estimate the contribution of each age-cause group to the total inequality in life expectancy at birth between two populations. For any given period, the total inequality in life expectancy at birth between the first and tenth deciles is the sum of the age-cause specific components. The total contribution of a particular age group to the inequality in life expectancy is the sum of its contributions across all causes of death, and the contribution of a particular cause of death is the sum of its contributions across age groups.

We analyzed ten leading causes of death for men and women in Québec.¹⁶ Important cancers (prostate, lung, breast, colorectal), motor vehicle accidents, and causes of infant mortality were analyzed separately. Human immunodeficiency virus (HIV) was included as a separate category because HIV incidence and mortality peaked in Canada during the period under study.¹⁷ We used the primary cause of death, defined as "the disease or injury which initiated the train of events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury."¹⁸ Appendix 2 lists the International Classification of Diseases codes.

Statistical analyses were performed using R and Microsoft Excel. Research ethics approval requirement was waived by the institutional review board of the University of Montréal Hospital Centre.

RESULTS

Life expectancy increased in all deciles between 1989-92 and 2001-2004, but the increase was larger for the least-deprived decile (Table 1b). It is notable that Québec does not experience a strictly stair-stepped gradient in life expectancy by material deprivation. For example, some of the middle deciles (e.g., decile 5) enjoyed higher life expectancies than less-deprived deciles. However, the least-deprived decile consistently had a higher life expectancy than any other, and the difference between the least- and most-deprived deciles constituted the largest inequality.

Between 1989-92 and 1995-98, the life expectancy gap between the most- and least-deprived deciles increased by 19% (0.44 years) for women and 21% (0.76 years) for men (Table 2). Between 1995-98 and 2001-04, inequality among females grew by a further 7%, to 3.0 years. Among males, on the other hand, life expectancy inequality decreased very slightly.

Contributions to life expectancy inequality in each period by cause of death and age

Among males, cancer made the largest contribution to inequality in each period (Table 2). Lung cancer alone accounted for 16-18% of the total gap. Among females, the contribution of cancer, which was only 5.6% in the first period, became the second-largest component of inequality (15.4%) in 2001-04. This was largely due to lung cancer mortality, which rose more among women in the most-deprived decile. During the first period, breast cancer mortality was higher in the least-deprived decile, making inequality between the

Table 2. Contribution of Major Causes of Death to Inequality in Life Expectancy Between the Bottom and Top Area-Socio-economic Deciles in Each Period, Québec

Cause of Death	Inequality in Life Expectancy, Years (%)					
	Males			Females		
	1989-1992	1995-1998	2001-2004	1989-1992	1995-1998	2001-2004
Cancer	0.91 (25.5)	0.98 (22.5)	1.10 (25.8)	0.13 (5.6)	0.43 (15.4)	0.60 (19.9)
Lung	0.66 (18.5)	0.68 (15.7)	0.69 (16.3)	0.06 (2.7)	0.24 (8.5)	0.44 (14.7)
Breast	0	0	-0.001 (-0.03)	-0.13 (-5.7)	-0.02 (-0.7)	-0.03 (-0.9)
Colorectal	0.04 (1.0)	0.01 (0.3)	0.07 (1.7)	0.07 (2.8)	0.05 (1.8)	0.05 (1.8)
Prostate	-0.02 (-0.5)	0.03 (0.6)	0.04 (0.9)	0	0	0
Other cancers	0.23 (6.5)	0.26 (5.9)	0.30 (6.9)	0.13 (5.7)	0.16 (5.8)	0.14 (4.3)
Heart Disease	0.65 (18.2)	0.78 (17.8)	0.63 (14.8)	0.76 (32.2)	0.80 (28.4)	0.71 (23.7)
Cerebrovascular diseases	0.17 (4.8)	0.05 (1.1)	0.09 (2.1)	0.21 (8.8)	0.07 (2.4)	0.22 (7.3)
Chronic lower respiratory diseases	0.27 (7.6)	0.35 (8.0)	0.38 (8.8)	0.11 (4.8)	0.14 (5.0)	0.18 (6.0)
Diabetes	0.04 (1.0)	0.06 (1.4)	0.12 (2.7)	0.12 (5.2)	0.15 (5.3)	0.18 (6.0)
Nephritis, Nephrosis, Nephritic syndrome	-0.02 (-0.7)	0.03 (0.8)	0.03 (0.7)	0.07 (2.8)	0.04 (1.5)	0.09 (3.0)
Alzheimer's	0.006 (0.2)	0.03 (0.7)	0.001 (0.03)	0.03 (1.3)	0.06 (2.1)	0.08 (2.8)
Unintentional Injury	0.87 (24.2)	0.91 (21.0)	0.73 (17.1)	0.32 (13.4)	0.29 (10.2)	0.22 (7.3)
Motor vehicle accidents	0.54 (15.2)	0.60 (13.8)	0.50 (11.7)	0.30 (12.8)	0.24 (8.5)	0.17 (5.7)
Falls	0.03 (1.0)	0.02 (0.5)	0.05 (1.1)	0.004 (0.2)	0.02 (0.7)	-0.01 (-0.3)
Other unintentional injuries	0.29 (8.0)	0.29 (6.6)	0.18 (4.3)	0.01 (0.4)	0.03 (1.0)	0.06 (1.9)
Suicide	0.40 (11.3)	0.51 (11.8)	0.47 (11.1)	0.03 (1.4)	0.06 (2.2)	0.07 (2.2)
Homicide	-0.004 (-0.1)	0.01 (0.2)	0.01 (0.3)	0.0004 (0.02)	-0.003 (-0.1)	-0.02 (-0.5)
HIV	-0.23 (-6.3)	-0.03 (-0.7)	0.04 (0.9)	0.006 (0.2)	0.01 (0.5)	0.01 (0.4)
Influenza and Pneumonia	0.001 (0.03)	0.05 (1.0)	0.05 (1.3)	0.004 (0.2)	0.06 (2.1)	0.07 (2.3)
Infant Mortality	0.03 (0.8)	0.10 (2.3)	0.07 (1.6)	0.14 (5.7)	0.07 (2.6)	0.07 (2.3)
Congenital anomalies	-0.02 (-0.6)	0.03 (0.8)	0.05 (1.2)	0.04 (1.7)	0.01 (0.4)	-0.01 (-0.4)
Other causes	0.05 (1.5)	0.07 (1.6)	0.02 (0.5)	0.10 (4.0)	0.06 (2.2)	0.08 (2.7)
Residual	0.48 (13.4)	0.53 (12.1)	0.54 (12.6)	0.43 (18.4)	0.63 (22.3)	0.52 (17.3)
Total	3.60 (100)	4.36 (100)	4.25 (100)	2.37 (100)	2.81 (100)	3.01 (100)

Table 3. Contribution of Age Groups to Inequality in Life Expectancy Between the Bottom and Top Area-Socio-economic Deciles in Each Period, Québec

Age Group	Inequality in Life Expectancy, Years (%)					
	Males			Females		
	1989-1992	1995-1998	2001-2004	1989-1992	1995-1998	2001-2004
<1	0.1 (2.6)	0.16 (3.7)	0.08 (1.92)	0.20 (8.5)	0.10 (3.4)	0.08 (2.7)
1-14	0.1 (2.7)	0.22 (5.1)	0.11 (2.5)	0.12 (4.9)	0.11 (3.9)	0.04 (1.3)
1-4	0.01 (0.2)	0.09 (2.1)	0.04 (0.9)	0.08 (3.2)	0.09 (3.1)	0.02 (0.7)
5-9	0.05 (1.5)	0.07 (1.6)	0.04 (1.0)	0.04 (1.7)	-0.01 (-0.5)	-0.01 (-0.3)
10-14	0.04 (1.0)	0.07 (1.5)	0.03 (0.6)	-0.001 (-0.05)	0.04 (1.3)	0.03 (0.9)
15-44	0.94 (25.9)	1.17 (27.0)	1.03 (24.2)	0.35 (14.6)	0.41 (14.5)	0.25 (8.4)
15-19	0.17 (4.6)	0.15 (3.5)	0.17 (3.9)	0.01 (0.4)	0.05 (1.6)	0.05 (1.7)
20-24	0.22 (6.1)	0.31 (7.1)	0.21 (4.8)	0.08 (3.3)	0.08 (2.9)	0.01 (0.3)
25-29	0.21 (5.8)	0.21 (4.8)	0.13 (3.1)	0.01 (0.5)	-0.002 (-0.08)	0.003 (0.08)
30-34	0.11 (3.0)	0.16 (3.6)	0.11 (2.6)	0.07 (3.0)	0.09 (3.2)	0.03 (0.9)
35-39	0.13 (3.6)	0.14 (3.3)	0.19 (4.3)	0.07 (3.1)	0.11 (4.0)	0.09 (3.0)
40-44	0.10 (2.8)	0.20 (4.6)	0.23 (5.4)	0.10 (4.2)	0.08 (2.8)	0.07 (2.4)
45-64	1.38 (38.0)	1.49 (34.4)	1.34 (31.5)	0.58 (24.5)	0.73 (26.1)	0.83 (27.7)
45-49	0.31 (8.4)	0.27 (6.3)	0.24 (5.6)	0.04 (1.7)	0.16 (5.8)	0.15 (5.1)
50-54	0.31 (8.7)	0.39 (8.9)	0.32 (7.4)	0.11 (4.8)	0.18 (6.5)	0.23 (7.5)
55-59	0.39 (10.7)	0.44 (10.1)	0.35 (8.1)	0.22 (9.4)	0.18 (6.4)	0.26 (8.7)
60-64	0.37 (10.3)	0.39 (9.1)	0.44 (10.3)	0.20 (8.6)	0.21 (7.4)	0.20 (6.5)
≥65	1.12 (30.7)	1.30 (29.9)	1.70 (39.9)	1.13 (47.6)	1.47 (52.1)	1.81 (59.9)
65-69	0.38 (10.6)	0.33 (7.5)	0.45 (10.6)	0.15 (6.2)	0.17 (6.2)	0.26 (8.6)
70-74	0.22 (6.0)	0.28 (6.5)	0.39 (9.1)	0.15 (6.4)	0.20 (7.2)	0.23 (7.7)
75-79	0.25 (6.9)	0.29 (6.8)	0.29 (6.7)	0.20 (8.5)	0.34 (12.2)	0.23 (7.6)
80-84	0.13 (3.5)	0.20 (4.5)	0.27 (6.5)	0.17 (7.0)	0.20 (7.1)	0.31 (10.3)
85-89	0.04 (1.1)	0.12 (2.8)	0.15 (3.6)	0.20 (8.4)	0.24 (8.6)	0.35 (11.7)
≥90	0.10 (2.6)	0.07 (1.7)	0.15 (3.4)	0.26 (11.0)	0.30 (10.6)	0.42 (14.0)
Total	3.60 (100)	4.36 (100)	4.25 (100)	2.37 (100)	2.81 (100)	3.01 (100)

most- and least-deprived deciles 0.13 years smaller than it would have been otherwise. In the second and third periods, this difference decreased, reflecting slower reductions in breast cancer mortality among women in the most-deprived decile than in the least-deprived.

Heart disease contributed a large share to life expectancy inequality in each period (women 24-32%, men 15-18%). Unintentional injuries (primarily motor vehicle accidents) were also major contributors (men 17-24%, women 7-13%).

Mortality attributable to HIV among men was higher in the least-deprived decile than in the most-deprived in 1989-92, thereby reducing the life expectancy gap. By 1995-98, however, HIV no longer had a 'reverse' socio-economic gradient, and in 2001-04, HIV contributed positively to inequality between the most- and least-

deprived decile. Other important components of inequality among males were heart disease and suicide. In the first period, deaths in middle-aged men (45-64 years) made the largest contribution, accounting for 38% of life expectancy inequality (Table 3). By the third period, however, deaths in men 65 years and over made the largest contribution (40%). The share of inequality resulting from deaths in the 15-44 age category was relatively stable over time.

Among females, mortality in the over 65 age group was the largest contributor to life expectancy inequality. The share of inequality due to deaths in this age group increased over time from 48% to 60%. The proportion of inequality due to deaths in middle age (45-64 years) also rose over time. The contribution to inequality in life expectancy from 15-44 year olds was much lower among females than it was among males, and fell over the three periods.

Figure 1. Contribution of each cause of death to the change in inequality in life expectancy between the bottom and top area-socio-economic deciles over time

Change in life expectancy inequality over time by cause of death

Roughly 25% of the increase in inequality among males from 1989-92 to 1995-98 was due to reductions in HIV mortality that favoured males in the least-deprived decile (Figure 1). Among females, the growth of inequality over time was largely driven by increases in lung cancer mortality in the most-deprived decile. Lung cancer increased life expectancy inequality by 0.17 years from 1989-92 to 1995-98, and again by 0.20 years from 1995-98 to 2001-04. Unintentional injuries reduced inequality over time for both men and women, due to greater reductions in mortality from motor vehicle accidents in the most- than in the least-deprived decile.

Between 1995-98 and 2001-04, the total inequality in life expectancy among males marginally decreased due to offsetting trends for different causes of death.

DISCUSSION

Our analysis indicates that the widening life expectancy gap between advantaged and disadvantaged areas in Québec from 1989-2004 was driven by relatively few causes of death. Among men, HIV was an important cause of the growth in inequality. Among women, lung cancer drove the steady increase in inequality between the most- and least-deprived areas. Heart disease accounted for a sizeable portion of inequality among both sexes in each period. Inequality among both sexes was reduced by a decrease in mortality from unintentional injuries. Contrary to the findings of a previous Canada-wide study, most causes of life expectancy inequality were amenable to public health intervention rather than medical care.¹⁹

Since 1989, heart disease mortality decreased more among people living in the least-deprived decile compared to the most-deprived, which is consistent with data linking heart disease with area-level socio-economic status in several contexts.¹ Rurality of the most-deprived decile (Table 1a) may also play a role in the continued contribution of heart disease mortality to life expectancy inequality. Other Canadian studies have found that risk factors for heart disease such as smoking and obesity are higher in rural areas,^{20,21} but a Québec study found that mortality rates from heart disease were actually lower in rural areas than urban centres.²² Thus, socio-economic differences in risk factors and access to specialized services may be more important to ongoing inequality in heart disease mortality. Although heart disease did not play a major role in widening inequality over time, it was a large component of inequalities among both sexes in each period. This suggests that heart disease would be a useful target for interventions seeking to reduce inequality between the most- and least-deprived areas in Québec.

Growing inequality among Québec women has primarily been driven by lung cancer mortality. This finding is consistent with previous research showing that differences in lung cancer mortality between the most- and least-deprived women in Québec grew over the 1990s.⁴ Lung cancer mortality in Québec is rising among all women, but decreasing among men. These mortality trends may reflect historical changes in smoking behaviour. Whereas smoking began to decline among men in Québec in the mid-1960s, the percentage of women who smoked did not decrease until the early 1980s.⁴ Growth in female life expectancy inequality from lung cancer mortality, and the ongoing contribution made by lung cancer to inequality among males in each period, suggest that smoking

Appendix 1.

Population statistics and death counts are available for each CLSC in Quebec, facilitating the calculation of CLSC-specific mortality rates. These areas also represent useful, coherent divisions that capture the geographical pattern of deprivation in Québec. Resembling the Townsend index in methodology and concept, the deprivation index uses census measures of employment, average income, and persons without a high school diploma.¹ It is available for 1996 census enumeration areas. Four northern CLSCs were excluded due to missing census data. The remaining 162 CLSCs were classified into deciles of material deprivation using the deprivation index of enumeration areas to calculate a population-weighted index for each CLSC.² The deprivation index based on census data from 1996 (the central year of the data being considered) was used for all study periods, under the assumption that the geographical distribution of deprivation in Québec has been stable over the short time period considered here. This is a reasonable assumption given that another analysis found that the geographic pattern of material deprivation in Québec was the same whether the deprivation index was calculated using 1991 Census data or 2001 Census data.³ Work in other industrialized countries, such as Britain and the United States, has also found little change in the geography of material deprivation over time.⁴⁻⁶

REFERENCES

1. Townsend P. Deprivation. *J Soc Policy* 1987;16(2):125-46.
2. Auger N, Alix C, Zang G, Daniel M. Sex, age, deprivation and patterns in life expectancy in Quebec, Canada: A population-based study. *BMC Public Health* 2010;10(1):161.
3. Pampalon R, Hamel D, Gamache P. Recent changes in the geography of social disparities in premature mortality in Quebec. *Soc Sci Med* 2008;67:1269-81.
4. Dorling D, Mitchell R, Shaw M, Orford S, Smith GD. The ghost of Christmas past: Health effects of poverty in London in 1896 and 1991. *BMJ* 2000;321(7276):1547-51.
5. Singh G, Siahpush M. Widening socioeconomic inequalities in US life expectancy, 1980-2000. *Int J Epidemiol* 2006;35:969-79.
6. McCarthy M. Urban development and health inequalities. *Scand J Public Health Suppl.* 2002;59:59-62.

trends have differed between the most- and least-deprived areas. It is possible that public health measures and changing social norms that encouraged a decline in tobacco consumption had a greater impact on the population living in least-deprived areas than in the most-deprived.^{23,24} Geographic patterns of smoking behaviour may have also contributed to the increasing discrepancies in lung cancer mortality we observed. Surveys in Québec in the late 1980s and early 1990s found higher smoking rates in mid-sized cities, small towns and rural areas compared to urban centres.⁴ Screening for lung cancer is unlikely to explain inequalities as it has not been reliably shown to reduce lung cancer mortality.²⁵ In recent years, the prevalence of smoking among women in Québec has not fallen as much as for men. Among those aged 15-24, more females than males are current smokers.²⁶ Considering these trends, rising mortality from lung cancer among women in Québec and disparities between women in the most- and least-deprived areas seem likely to continue.

HIV mortality worsened inequality between men in the most- and least-deprived areas. This was surprising because HIV is a relatively uncommon cause of death. Deprived areas are primarily rural (although some are located in Montréal and Québec City), and HIV in Québec has been concentrated in urban centres.²⁷ Subanalyses indicated that growing inequality due to HIV among men reflected the high concentration of HIV mortality in urban deprived areas (data not shown). In Québec, as in other industrialized countries, HIV mortality peaked in the mid-1990s and then rapidly declined following the introduction of highly active antiretroviral treatment.²⁸ However, mortality fell more among men in the most-affluent areas than among those in deprived urban neighbourhoods. Poverty and deprivation may place people in vulnerable positions that constrain opportunities for protection from infection or treatment, even in the context of universal publicly-funded health insurance.^{29,30}

Appendix 2. ICD Codes for Cause of Death Categories

	ICD-9	ICD-10
All Cancers	140-208	C00-C97
Lung Cancer	162	C33-C34
Breast Cancer	174	C50
Prostate Cancer	185	C61
Colorectal Cancer	153-154	C18-C21
Heart Disease	390-398, 402, 404, 410-429, 115, 999.1, 093.81, 098.83, 093.21, 032.82, 130.3, 093.22, 093.23, 093.24, 093.20, 093.82	I00-I09, I11, I13, I20-I51
Unintentional Injury	E800-E869, E880-E929	V01- X59, Y85-Y86
Motor Vehicle Accidents	E810-E825	V02-V04, V09.0, V09.2, V12-V14, V19.0-V19.2, V19.4-V19.6, V20 V79, V80.3-V80.5, V81.0-V81.1, V82.0-V82.1, V83-V86, V87.0-V87.8, V88.0-V88.8, V89.0, V89.2
Falls	E880-E888	W00-W19
Suicide	E950-E959	X60-X84, Y87.0
Cerebrovascular Diseases	430-434, 436-438	I60-I69
Chronic Lower Respiratory Diseases	490-494	J40-J47
HIV	42-44	B20-B24
Diabetes	250	E10-E14
Influenza and Pneumonia	480-487	J10-J18
Alzheimer's	331.0	G30
Nephritis, Nephrosis, Nephritic Syndrome	580-583, 584-586, 588-589	N00- N07, N17-N19, N25-N27
Homicide	960-968, 904, 969.08	X85-Y09, Y87.1
Infant Mortality		
Congenital Anomalies	740-759	Q00-Q99
Other Major Causes	761, 763-763.4, 763.6-763.9, 762, 798.0, 765	P01, P02, P03, R95, P07

Several limitations of this study should be mentioned. Previous research has shown that results of area-level analyses often differ depending on spatial unit.^{1,6} It is possible that alternative area boundaries in Québec could produce different results. In particular, analyses based on smaller, more homogenous areal units would come closer to capturing the inequalities that exist at an individual level.³¹ Nonetheless, we chose to analyze CLSCs because they are meaningful administrative units with an important role in implementing policies and delivering health and social services that may reduce health disparities. However, analyses based on smaller geographical units may give different results. Another limitation for the interpretation of results is the rural/urban composition of deprivation deciles. The most-deprived decile is primarily rural, but includes some urban CLSCs in Montréal and Québec City. The least-deprived decile is almost exclusively urban. Thus, differences between the most- and least-deprived deciles also reflect rural-urban differences, but we view the fact that rural areas are more materially deprived as an important feature of socio-economic disparities in Québec. The exclusion of four northern CLSCs – primarily First Nations and Inuit settlements – due to incomplete census data could have led to underestimates of the magnitude of life expectancy inequalities since Aboriginal Canadians experience poorer health outcomes than the non-indigenous population.^{32,33} Finally, we could not account for the change in mortality coding from ICD-9 to ICD-10 in year 2000, which could have influenced results. However, any systematic error introduced by the coding shift would have had to be different between the advantaged and disadvantaged areas to seriously affect our results. Given that mortality coding is performed at a provincial rather than a regional level, this seems unlikely.³⁴

Absolute inequalities in life expectancy at birth between the least- and most-deprived areas of Québec have increased over time, particularly among women. Much of the increase in inequality was driven by diseases best addressed by preventive public health measures. Public health initiatives that do not widen inequalities by disproportionately benefiting the most well off are necessary to reverse this trend.

REFERENCES

1. Diez Roux A. Neighborhoods and health: Where are we and where do we go from here? *Rev Epidemiol Santé Publique* 2007;55(1):13-21.
2. Lebel A, Pampalon R, Villeneuve PY. A multi-perspective approach for defining neighbourhood units in the context of a study on health inequalities in the Quebec City region. *Int J Health Geogr* 2007;6:27.
3. Pampalon R, Lebel A, Hamel D. Exploring rural health inequalities at a local scale: The case of Portneuf, Quebec. *Can J Public Health* 2007;98(2):143-48.
4. Pampalon R, Denis H, Gamache P. Recent changes in the geography of social disparities in premature mortality in Quebec. *Soc Sci Med* 2008;67:1269-81.
5. Ross N, Tremblay S, Graham K. Neighbourhood influences on health in Montréal, Canada. *Soc Sci Med* 2004;59(7):1485-94.
6. Pickett KE, Pearl M. Multilevel analyses of neighbourhood socioeconomic context and health outcomes: A critical review. *J Epidemiol Community Health* 2001;55(2):111-22.
7. Mooney H. Life expectancy in England between the rich and poor widens for both men and women. *BMJ* 2009;339:b2775.
8. Singh G, Siahpush M. Widening socioeconomic inequalities in US life expectancy, 1980-2000. *Int J Epidemiol* 2006;35:969-79.
9. Auger N, Alix C, Zang G, Daniel M. Sex, age, deprivation and patterns in life expectancy in Quebec, Canada: A population-based study. *BMC Public Health* 2010;10(1):161.
10. The Chief Public Health Officer's Report on the State of Public Health in Canada 2008: Addressing Health Inequalities. Ottawa, ON: Public Health Agency of Canada, 2008.
11. Pelletier G. La population du Québec par territoire des centres locaux de services communautaires, par territoire des réseaux locaux de services et par région sociosanitaire de 1981 à 2026. Direction des communications, Ministère de la Santé et des Services sociaux du Québec, 2005.
12. Pampalon R, Raymond G. A deprivation index for health and welfare planning in Quebec. *Chron Dis Can* 2000;21(3):104-13.
13. Preston S, Heuveline P, Guillot M. *Demography: Measuring and Modeling Population Processes*. Padstow, Cornwall: Blackwell Publishing, 2001.
14. Arriaga EE. Measuring and explaining the change in life expectancies. *Demography* 1984;21(1):83-96.
15. Arriaga EE. Changing trends in mortality decline during the last decades. In: Ruzicka L, Wunsch G, Kane P (Eds.), *Differential Mortality: Methodological Issues and Biosocial Factors*. Oxford, UK: Clarendon Press, 1989.
16. Leading Causes of Death in Canada. Ottawa, ON: Statistics Canada, 2005.
17. The Centre for Health Promotion UoT. Technical Report 2: Key Trends in HIV/AIDS in Canada. Ottawa, ON: Health Canada, 2000.
18. International Statistical Classification of Diseases, 10th Revision (ICD-10). Geneva, Switzerland: World Health Organization, 1992.
19. James PD, Wilkins R, Detsky AS, Tugwell P, Manuel DG. Avoidable mortality by neighbourhood income in Canada: 25 years after the establishment of universal health insurance. *J Epidemiol Community Health* 2007;61(4):287-96.
20. Lagace C, Desmeules M, Pong RW, Heng D. Non-communicable disease and injury-related mortality in rural and urban places of residence: A comparison between Canada and Australia. *Can J Public Health* 2007;98(Suppl 1):S62-S69.
21. Mitura V, Bollman R. The health of rural Canadians: A rural-urban comparison of health indicators. *Rural and Small Town Canada Analysis Bulletin* 2003;4(6):1-23.

22. Pampalon R, Martinez J, Hamel D. Does living in rural areas make a difference for health in Quebec? *Health & Place* 2006;12(4):421-35.
23. Jarvis MJ, Wardle J. Social patterning of individual health behaviours: The case of cigarette smoking. In: Marmot M, Wilkinson R (Eds.), *Social Determinants of Health*. Oxford, UK: Oxford University Press, 2006.
24. Flint AJ, Novotny TE. Poverty status and cigarette smoking prevalence and cessation in the United States, 1983-1993: The independent risk of being poor. *Tobacco Control* 1997;6(1):14-18.
25. Black C, de Verteuil R, Walker S, Ayres J, Boland A, Bagust A, et al. Population screening for lung cancer using computed tomography, is there evidence of clinical effectiveness? A systematic review of the literature. *Thorax* 2007;62(2):131-38.
26. Bernier S, Hamel D. Évolution de l'usage de la cigarette chez les Québécois de 15 ans et plus de 1994-1995 à 2003. Institut national de santé publique du Québec, 2006.
27. A National Portrait – A Report on Governments' Responses to the HIV/AIDS Epidemic in Canada. Ottawa, ON: Public Health Agency of Canada, 2005.
28. Schanzer D. Trends in HIV/AIDS mortality in Canada, 1987-1998. *Can J Public Health* 2003;94(2):135-39.
29. Wood E, Montaner JS, Tyndall MW, Schechter MT, O'Shaughnessy MV, Hogg RS. Prevalence and correlates of untreated human immunodeficiency virus type 1 infection among persons who have died in the era of modern anti-retroviral therapy. *J Infect Dis* 2003;188(8):1164-70.
30. Wood E, Montaner JS, Chan K, Tyndall MW, Schechter MT, Bangsberg D, et al. Socioeconomic status, access to triple therapy, and survival from HIV-disease since 1996. *AIDS* 2002;16(15):2065-72.
31. Murray CJ, Frenk J, Gakidou EE. Measuring health inequality: Challenges and new directions. In: Leon DA, Walt G (Eds.), *Poverty, Inequality and Health: An International Perspective*. Oxford: Oxford University Press, 2001.
32. Wilkins R, Uppal S, Fines P, Senecal S, Guimond E, Dion R. Life expectancy in the Inuit-inhabited areas of Canada, 1989 to 2003. *Health Rep* 2008;19(1): 7-19.
33. A Statistical Profile on the Health of First Nations in Canada in 2000. Ottawa, ON: Health Canada, 2005.
34. Geran L, Tully P, Wood P, Thomas B. Comparability of ICD-10 and ICD-9 for Mortality Statistics in Canada. Ottawa, ON: Statistics Canada, 2005.

Received: October 20, 2010

Accepted: March 24, 2011

RÉSUMÉ

Objectifs : Les inégalités dans l'espérance de vie entre les régions les plus et les moins défavorisées matériellement sont en hausse dans la province de Québec, au Canada. Nous avons évalué les causes de décès et les groupes d'âge qui ont contribué à cette tendance.

Méthode : Nous avons analysé les données de mortalité au Québec sur trois périodes de quatre ans, de 1989 à 2004. Les différences d'espérance de vie à la naissance entre les régions les plus et les moins défavorisées dans chaque période, et au fil du temps, ont été décomposées par âge et par cause de décès pour les hommes et les femmes en utilisant la méthode d'Arriaga.

Résultats : L'espérance de vie a augmenté dans toutes les régions, mais l'augmentation a été plus faible dans les zones défavorisées. Le cancer, les maladies cardiovasculaires et les blessures involontaires ont le plus contribué aux inégalités dans l'espérance de vie durant chaque période. Chez les femmes, l'élargissement de l'écart d'espérance de vie est largement attribuable à une augmentation de la mortalité par cancer du poumon. Chez les hommes, la mortalité due au VIH est une cause importante de l'élargissement des inégalités. Chez les deux sexes, les inégalités croissantes dans l'espérance de vie sont compensées par une diminution de la mortalité due aux blessures involontaires dans les zones défavorisées (réduisant l'écart entre les régions les plus et les moins défavorisées). La plus grande part des inégalités dans l'espérance de vie des femmes est attribuable aux décès dans le groupe d'âge des 65 ans et plus. Chez les hommes, la plus grande part est passée du groupe des 45 à 64 ans au groupe des 65 ans et plus sur l'ensemble de la période.

Conclusion : L'écart d'espérance de vie entre les zones favorisées et défavorisées au Québec s'élargit en raison d'un assez petit nombre de causes de décès dont les facteurs de risque sont connus et qui peuvent faire l'objet de stratégies de prévention.

Mots clés : espérance de vie; inégalités de santé; défavorisation

MANGEZ DES ALIMENTS SALUBRES!

POUR LES CANADIENS À RISQUE PLUS ÉLEVÉ

[ACCUEIL](#) | [À PROPOS](#) | [NOUS JOINDRE](#) | [ENGLISH](#)

LES AÎNÉS

LES FEMMES ENCEINTES

LES PERSONNES ATTEINTES DU VIH

LES PERSONNES EN TRAITEMENT CONTRE LE CANCER

[TÉLÉCHARGEMENT DE DOCUMENTS MULTILINGUES](#)

Bienvenue

Bienvenue sur ce site où vous trouverez quelques moyens faciles et pratiques pour préserver la salubrité de vos aliments.

Les mécanismes canadiens de salubrité des aliments figurent parmi les plus sûrs du monde. Néanmoins, malgré les efforts du gouvernement et de l'industrie des produits alimentaires, et en dépit de la vigilance des consommateurs pour préserver la salubrité des aliments consommés à la maison, on recense annuellement de 11 à 13 millions de cas de maladies d'origine alimentaire au pays. Vous pouvez cependant protéger votre propre santé en suivant quelques conseils simples et pratiques sur le choix, la conservation et la préparation de vos aliments.

La salubrité des aliments s'avère particulièrement importante pour les personnes faisant partie de groupes ciblés qui sont plus vulnérables aux germes parfois présents dans nos aliments, soit :

- les aînés;

MANGEZ DES ALIMENTS SALUBRES!

est une nouvelle ressource en ligne qui aide les gens à minimiser leur risque personnel de maladies transmises par l'alimentation.

Le site web contient des feuillets de documentation que l'on peut télécharger en format PDF en français, en anglais, et dans 11 autres langues : arabe, chinois, farsi (persan), inuktitut, coréen, punjabi, russe, espagnol, tagalog, tamil et urdu.

La production de cette ressource, qui vise les membres de groupes à risques élevés, leurs soignants et la population en général, a été rendue possible grâce à une subvention à l'éducation sans restrictions versée par les Aliments Maple Leaf Inc.

Visitez le site Web MANGEZ DES ALIMENTS SALUBRES! à l'adresse <http://salubritealimentaire.cpha.ca>