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**Conclusion:** LE is lower for males than females, and shorter in the North than in the South consistent with limited primary health care, higher rates of smoking, heavy drinking and obesity, higher levels of long-term unemployment, fewer high school and university graduates, a relatively larger Aboriginal population and being generally rural and remote.

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## I. INTRODUCTION

Life expectancy (LE) is frequently used as an indicator of the health of a population. Identifying gaps in life expectancy between different groups in different provinces and territories helps draw attention to particularly vulnerable populations in Canada. However, life expectancy measures the length rather than the quality of life, and does not necessarily represent the number of years spent in good health [1].

In the last five decades, life expectancy in Canada has been ranked in the top 10 among the 34 countries now in the Organization for Economic Co-operation and Development (OECD) [2-3]. In 2007, the most recent period for which data are available for all OECD countries, Canada ranked ninth, with a life expectancy at birth of 80.7 years for both sexes combined. This was 1.9 years lower than the first-ranked

country, Japan. Canadian men were in eighth place, 1.2 years below top-ranked Switzerland, and Canadian women were tied for ninth with Sweden, 3.0 years below Japan [4].

The gap in life expectancy between males and females differs by country. In Canada, life expectancy at birth is 4.6 years longer for women than men. Among the top 10 OECD countries, the gap in life expectancy is largest in France (7.0 years) and smallest in Iceland (3.5 years) [4].

The objective of this study is to identify where Canada has the highest overall life expectancy, and to relate the findings to associated health behaviours and socio-demographic characteristics.

## II. DATA AND METHODS

We used the Canadian Vital Statistics Death Database for the period of 1986 to 2007. All death records are based on information abstracted and compiled from death certificates and are provided to Statistics Canada by the vital statistics registrars in each province or territory. The mortality data in this analysis are coded using both the 9<sup>th</sup> and 10<sup>th</sup> Revision of the *International Classification of Diseases* (ICD-9 and ICD-10). Annual population estimates were taken from Statistics Canada's annual demographic statistics (Statistics Canada. Annual Demographic Estimates: Canada, Provinces and Territories 2011). For each province or territory (Northwest Territory, Yukon, and Nunavut) and health regions, overall average and sex-specific mortality rates were calculated for the study period. The annual population was considered as a weight to produce a weighted average of annual mortality rate and life expectancy for provinces/territories and health regions.

Life expectancy was then related to the health regions by age and sex. These variables were examined together, with socio-demographic characteristics. A peer group was created based on similarities in the populations of health regions along a number of sociological categories, including: income inequality; percentage of the population aged 65+; unemployment rate; property ownership; and average years of schooling [5]. We compared the significant differences among respective peer groups, provinces/territories and the Canadian national level group.

When the result is "0", this means there is no statistical difference; "+1" means there is a positive

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statistical difference; and “-1” means there is a negative statistical difference between compared groups.

LE analysis was conducted to explore time trend for Canadians mortality rate from 1986 to 2007 by all causes, age, and sex. All analyses were conducted by using SAS, version 9.1, statistical software.

### III. RESULTS

Life expectancy in Canada improved significantly from 1986 to 2007. Women's life

expectancy at birth increased from 79.8 years in 1986 to 83.0 years in 2007, while men's increased from 73.2 to 78.4 years in the same period—increases of 3.2 years for women and 5.2 for men (Figure 1).

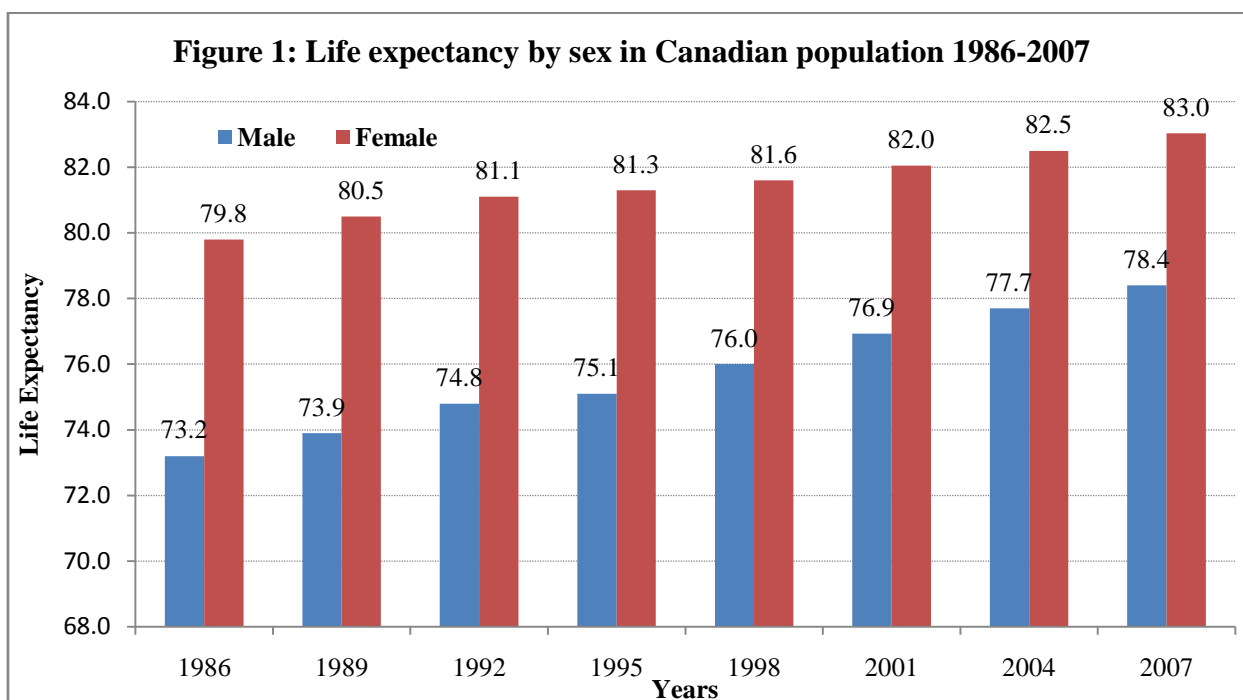
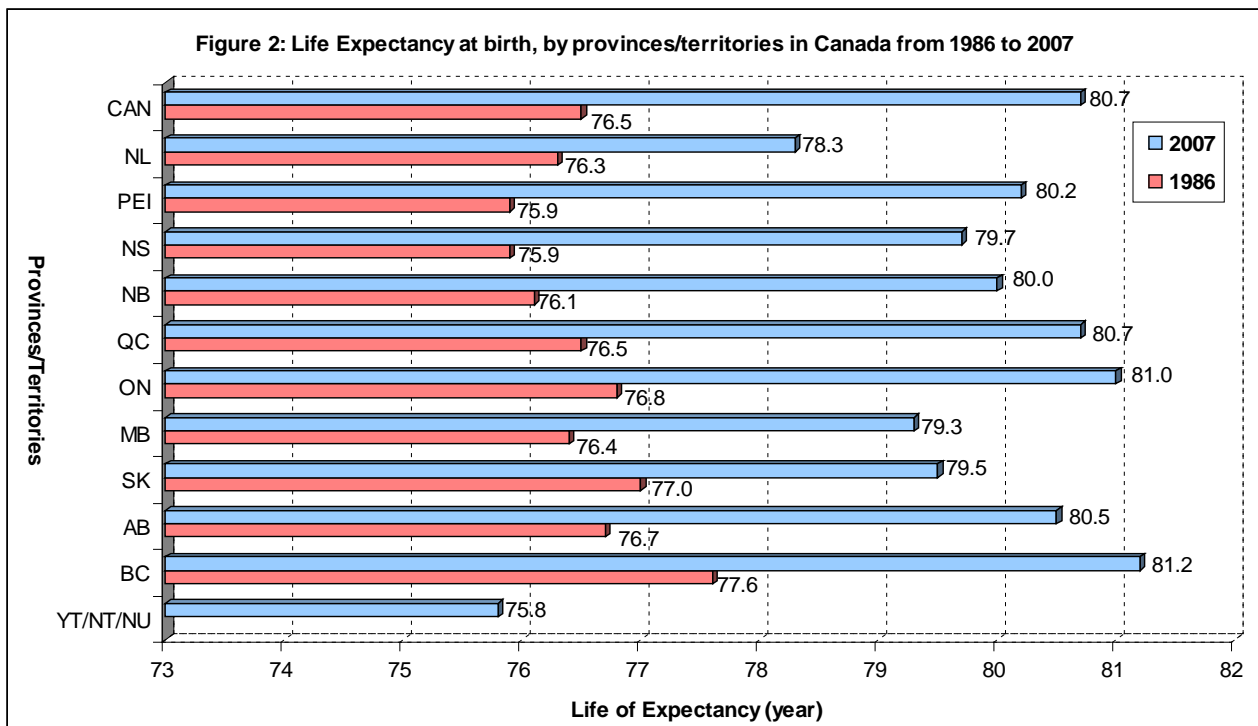


Figure 1 : Life expectancy by sex in Canadian population 1986-2007

Our study noted only modest variability in LE by province, with the only noteworthy exception being the much lower female LE in Newfoundland and Labrador. Figure 2 shows how life expectancy at birth varies across Canada. Among the provinces in 2007, British Columbia (BC) had the longest life expectancy, 81.2 years, following by Ontario (81.0), Quebec (80.7), Alberta (80.5), PEI (80.2), and New Brunswick (80.0). Newfoundland and Labrador had the lowest, 78.3 years. However, when we compare the differences between 1986 and 2007 period, we found that the highest increase in LE was for PEI, there are 4.3 years difference, higher than average (4.2) in the general population. Ontario was 4.2 years, the same as in the average LE in Canada. LE in other provinces and territories were lower than general population (Figure 2).



*Figure 2 : Life Expectancy at Birth, by Provinces/Territories in Canada from 1986 to 2007*

Notes: CAN-Canada; NL-Newfoundland and Labrador; PEI-Prince Edwards Island; NS-Nova Scotia; NB-New Brunswick; QC-Quebec; ON-Ontario; MB-Manitoba; SK-Saskatchewan; AB-Alberta; BC-British Columbia; YKT/NWT/NUT- Yukon Territory/North West Territory/Nunavut Territory

LE in the different health regions of different provinces and territories varied in health regions and sex. The three regions with the highest LE were Richmond Health Service Delivery Area (BC), York Regional Health Unit (ON), and Peel Regional Health Unit (ON) in both sexes (84.6, 83.8, 83.2), males (82.6, 82.0, 81.3), and females (86.2, 85.4, 84.9) respectively. In contrast, the three regions with the lowest LE were Région du Nunavik (QC), Burntwood/Churchill (MB), and Nunavut Territory in both sexes (71.3, 71.3, 72.0), males (69.3, 68.4, 68.9), and females (72.5, 74.6, 76.0). Results showed that the three highest LE have positive statistical difference in comparing with the previous reference period (+1), the Canadian national level (+1), the peer group rate (+1) and the provincial level (+1). However, the three regions with the lowest LE were negative statistical lower than the Canadian national level (-1), the peer group rate (-1) and the provincial level (-1). (Table 1, Map 1, Map 2).

**Table 1 :** Significant difference from Life expectancy (LE) at birth by health region compared to peer groups, provincial/territorial level and Canadian national level group in Canada 2005-2007\*

Table 1--- Significant difference from Life expectancy (LE) at birth by health region compared to peer groups, provincial/territorial level and Canadian national level group in Canada 2005-2007*									
		Life expectancy by sex and 95% confidential interval				Compared to Compared to previous national level peer group provincial level period			
Three top highest LE in the health regions									
Code	Both	95%C.I.	Male	95%C.I.	Femae	95%C.I.	Male	Female	Male Female
Richmond Health Service Delivery Area									
5931	84.6	84.2	84.9	82.6	82.1	83.2	86.2	85.7	86.7
							1	1	1
							1	1	1
							1	1	1
Peel Regional Health Unit									
3553	83.2	83.1	83.4	81.3	81.0	81.5	84.9	84.7	85.2
							1	1	1
							1	1	1
							1	1	1
York Regional Health Unit									
3570	83.8	83.6	83.9	82.0	81.7	82.3	85.4	85.1	85.6
							1	1	1
							1	1	1
							1	1	1
Three lowest LE in the health regions									
Nunavut	6201	72.0	70.5	73.4	68.9	67.2	70.6	76.0	73.3
							0	0	0
							-1	-1	0
							0	0	0
							-1	-1	0
							0	0	0
Région du Nunavik	2417	71.3	68.9	73.8	69.3	65.8	72.7	72.5	69.3
							0	0	0
							-1	-1	0
							0	0	-1
							-1	-1	1
							0	0	-1
Burntwood/Churchill	4685	71.3	70.3	72.2	68.4	67.1	69.7	74.6	73.1
							0	0	0
							-1	-1	-1
							-1	-1	1
							0	0	-1
							-1	-1	1

**Note:** 0---No statistically significant difference between compared groups  
1---Statistically significant difference above compared group  
-1---Statistically significant difference below compared groups

\* Data source: Statistics Canada, CANSIM table 102-4307

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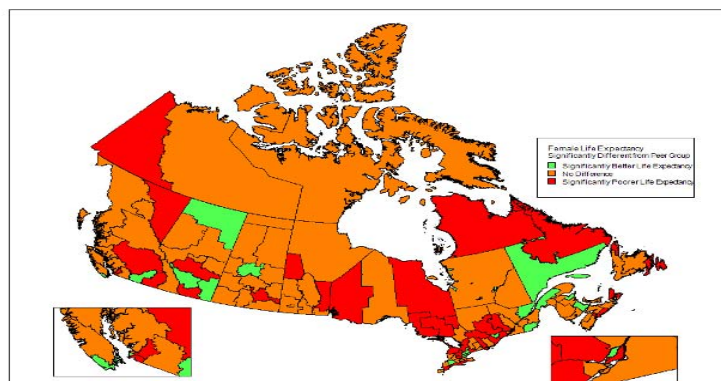


Figure 3 : Female life expectancy at birth by health region, significantly different from peer groups in Canada 2005–2007

Source: Statistics Canada. Vital Statistics. Life expectancy.

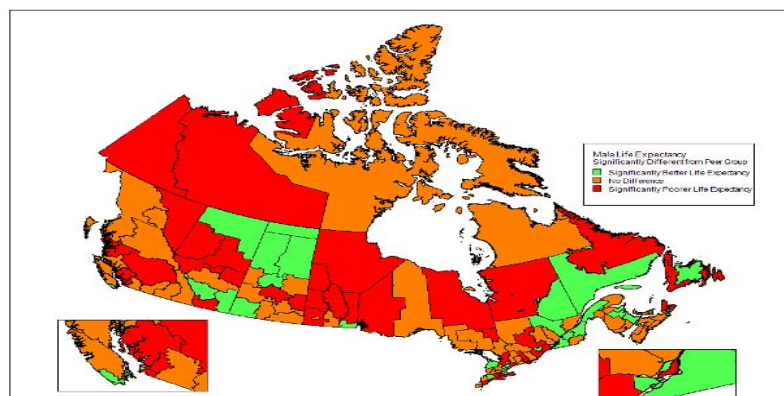


Figure 4 : Male life expectancy at birth by health region, significantly different from peer groups in Canada 2005–2007

Source: Statistics Canada. Vital Statistics. Life expectancy.

#### IV. DISCUSSION

Life Expectancy (LE) is a commonly used component of the Human Development Index (HDI), along with adult literacy, education, and standard of living [6].

Although our study noted only modest differences in LE by province, we observed large variations in LE by health regions. This highlights the importance of conducting surveillance with sufficient granularity to adequately inform public health action. Health regions with low LE in tended to be clustered in the north, while those with high LE in tended to be in regions in the south which were most urbanized and had experienced the highest levels of immigration. The most disadvantaged health units had life expectancies comparable to those experienced in Canada as a whole 40 years ago [7].

Life expectancy is lower for males than for females: this gap has been present to varying degrees for nearly a century. This gap between the sexes narrowed over the study period [8-10].

The reasons for this may be that life expectancy tends to be lower in regions with poor living conditions, a lack of primary health care, higher accident rates, and the rates of smoking, heavy drinking and obesity are relatively higher than other regions in Canada [11-16].

These regions also have higher rates of extended unemployment, fewer high school and university graduates, a relatively larger Aboriginal population and are generally tended to be more rural and remote [17].

Our results are comparable to those in some European countries and in Japan. The difference in life expectancy at birth between the best and worst European countries in this respect is more than 10 years for both sexes. Life expectancy at birth in the European Union-27 countries (new members after 2004) was 75.1 years (men) and 81.3 years (women). The difference between the 10th and 90th percentile of 272 regions was 8.0 (men) and 5.6 years (women). Men lived 6.1 years and women 3.9 years shorter in the new member states (NMS, new members since 2004) than in the European Union-15 countries.

The main causes explaining differences in life expectancy are ischemic and other heart disease, stroke, alcohol related mortality, lung cancer and injuries [18-21]. The contributions of medical care and pollution are likely to be modest; health behaviour, diet, and alcohol consumption seem to be more important; smoking seems to have the largest impact [11-13, 22-24]. In contrast, people in health regions with life expectancy higher than the Canadian average practice good health behaviours, have high average years of schooling, high



levels of property ownership, and there is a high proportion of immigrants, and low unemployment.

## V. CONCLUSION

Life expectancy in Canada has increased substantially over the last 25 years, and Canada ranks consistently among the top countries in the world. At the same time there are large regional differences. Contributing reasons likely include poor living conditions, access to limited primary health care, and higher rates of smoking, heavy drinking and obesity. These regions also have higher rates of long-term unemployment, fewer high school and university graduates, a relatively larger Aboriginal population and rural and remote.

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