



Cancer among Aboriginal people living on
reserves and in Northern villages in Québec,
1984-2004

INCIDENCE AND MORTALITY

INSTITUT NATIONAL
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Québec 

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Direction des risques biologiques,
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FOREWORD

Cancer incidences and cancer deaths are increasing very rapidly among the Aboriginal populations. While this issue, some decades ago, was almost inexistent, it is today an important concern to those populations and to the public health authorities.

A United States and Canada Joint Review Committee on Cancer among Aboriginals has been created to develop and standardize cancer monitoring methods specifically designed for the North America's Aboriginal populations. Besides providing a comprehensive framework, the Committee opens the possibility to realize a comparison study covering both countries diverse Aboriginal Nations which was not always the case in the past. More so, the Committee endorses the actual monograph as a component of its framework.

This study provides an actual portrait of cancer occurrences within the Province of Québec Aboriginal and Inuit populations, and is a testimony of its evolution from 1984 to 2004. Furthermore, to compensate for the lack of an Aboriginal Cancer Registry, this study explores the possibility of using the place of residence included in the Fichier des tumeurs (Tumour File) and the Fichier des décès (Record of Death) to identify the new cancer cases and cancer deaths among the Aboriginal populations living on Amerindian Reserves and Northern villages. Even though a small portion of the reserves and Northern villages' residents is not of Aboriginal or Inuit origin, the proposed method by default of representing a specific reality, allows measuring the extent of this area of concern.

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1 INTRODUCTION

To our knowledge no data on cancer incidence and mortality among the Aboriginal population of Québec has been published. The only known reference was in a study examining the creation of a cancer registry during a specific period of the 1970s and 1980s. The study found that cancer was virtually non-existent within this population (1). Indeed, between 1969 and 1989 only 180 cases were reported in Nunavik, though the numbers tended to increase each year during that period (1). Studies in Canada and the United States suggest that the profile of Aboriginal populations is different from the general population. This small population group shows a low cancer incidence (1-10) and a low cancer mortality rate, (2, 6, 8, 10-15).

Notwithstanding these low rates, an increase in cancer (incidence and mortality) has been observed (3, 4, 8). The change in lifestyle of these populations may prompt the emergence of chronic pathologies, including cancer, which has previously been present mainly in non-Aboriginal populations. This change is of concern to public health authorities.

In Québec there are 11 Aboriginal nations spread across 59 reserves and villages. These Nations are the Abenaki, Algonquin, Atikamekw, Cree, Huron-Wendats, Inuit, Malecite, Micmac, Mohawk, Innu and Naskapi. They are spread out across Québec's 18 health regions. Cancer surveillance among these nations, starting with the Tumour File and the mortality file, is problematic as there is nothing in the databases to distinguish Aboriginals from the overall population.

By using area of residence in the Tumour File and the mortality file, this study tries to identify cancer cases among Aboriginals in order to draw an actual pattern of cancer in the Aboriginal population living on reserves and in Northern villages and to determine its evolution between 1984 and 2004. This work is done within the framework of an Aboriginal cancer surveillance committee in the United States and Canada. The committee was recently established and includes Québec's participation. The committee aims to standardize cancer surveillance among North American Aboriginals and to allow for comparisons between Aboriginal nations of the two countries, as previous studies have used different methodologies.

2 OBJECTIVES

The main objective of this study is to identify new cancer cases in the Tumour File and deaths by cancer in the mortality file for the Aboriginal population between 1984 and 2004 based on area of residence.

The specific goals are to:

- Identify cancer cases among Québec Aboriginals based on the Tumour File and estimate the incidence of cancer among this population;
- Identify deaths by cancer among Québec Aboriginals based on the mortality file and estimate cancer mortality;
- Document time trends of the rate of cancer incidence and mortality among these populations;
- Compare these rates with those of the general population of Québec.

3 METHODS

3.1 SOURCES OF DATA

3.1.1 Data on cancer incidence and mortality

The data on the incidence of cancers diagnosed between 1984 and 2004 inclusively come from the Québec Tumour File (QTF), which is based on hospitalization and outpatient surgery files. Anyone with cancer hospitalized for general and specialized care or treated in outpatient surgery clinics in Québec are registered in the Tumour File. Cancers are coded according to the ninth revision of the International Classification of Diseases (ICD-9). The cancer codes used are 140 to 208, excluding code 173 (skin cancer other than melanoma) as this cancer is highly under-reported in the QTF.

Cancer mortality data between 1984 and 2004 inclusively comes from the Fichier des décès du Québec (Québec mortality file). From 1984 to 1999, causes of death were coded according to the ICD-9 (codes 140 to 208), and from 2000 to 2004 according to the 10th revision of the International Classification of Diseases (ICD-10) (codes C00 to C97).

These two databases, tumours and deaths, contain information on the municipality of residence. Reserves and Northern villages have different codes than municipalities where non-Aboriginals live even if they sometimes have the same name. A list of the reserve and Northern village codes, supplied by the ministère de la Santé et des Services sociaux du Québec, was used for identification in the QTF and the mortality file of new cases of cancer and deaths by cancer among Aboriginals.

3.1.2 Population

According to Indian and Northern Affairs Canada the Aboriginal population, as defined by the total number of people living on reserves and in Northern villages as of December 31, 2005, is 57,744 (Table 1). This total is made up of 48,236 Status Indians and 9,508 Inuits. However, this data does not provide information on age group nor gender.

The data on the Aboriginal population used to calculate the rate presented in the results section, is based on the population living on reserves and in Northern communities of Canada, provided by the 1991, 1996 and 2001 Censuses. This data is broken down by age group and gender. For the calculation of standardized rates, the reference population is that of the Canadian population in the 1991 Census, distributed by age group, with genders combined. It should be noted that certain reserves refused to be surveyed for the census, while others were uninhabited or had few residents. For these populations, Statistics Canada attributed a value of 0. Thus, of all the Aboriginal reserves in Québec (see Table 2) only 45 had population data for 1991, 46 for the 1996 Census and 49 in the 2001 Census. The Indian Reserves, for which population data was available in 2001, but not in 1991, are those of Lac-Simon, Mistissini, Oujé-Bougoumou and Wendake. As for the 1996 Census, no data is available for the Kitigan Zibi, Wendake and Wôlinak reserves. With the exception of the Wendake reserve, this data is estimated by applying the annual rate of change calculated from the available census data.

Table 1 **Distribution of Aboriginal populations living on reserves and in Northern villages according to Aboriginal nation in 2005, data from Indian and Northern Affairs Canada**

| Nation | Number | Proportion |
|---------------|---------------|-------------------|
| Abenaki | 370 | 0,6 |
| Algonquin | 5 350 | 9,3 |
| Atikamekw | 5 144 | 8,9 |
| Cree | 13 220 | 22,9 |
| Huron-Wendat | 1 307 | 2,3 |
| Inuit | 9 508 | 16,5 |
| Malecite | 2 | 0,0 |
| Micmac | 2 471 | 4,3 |
| Mohawk | 8 717 | 15,1 |
| Innu | 11 069 | 19,2 |
| Naskapi | 585 | 1,0 |
| Total | 57 744 | 100,0 |

Source: Indian and Inuit Population in Québec as of December 31, 2005 [online]. http://www.ainc-inac.gc.ca/qc/aqc/pop_e.htm (Consulted on March 7, 2007).

Table 2 Indian Reserves and Northern villages in Québec according to nation

| Nation | Reserve/village | Nation | Reserve/village |
|---------------------|------------------------|----------------|------------------------|
| Abenaki | Odanak | Inuit | Akulivik |
| | Wôlinak | | Aupaluk |
| Algonquin | Hunter's Point* | | Inukjuak |
| | Kebaowek | | Ivujivik |
| | Kitcisakik | | Kangiqsualujjuaq |
| | Kitigan Zibi | | Kangiqsujuaq |
| | Rapid Lake* | | Kangirsuk |
| | Lac-Simon | | Kuujuuaq |
| | Pikogan | | Kuujuuarapik |
| Atikamekw | Timiskaming | | Puvirnituq |
| | Winneway | | Quaqtaq |
| | Coucouchache* | | Salluit |
| | Manawan | | Tasiujaq |
| Cree | Obedjiwan | | Umiujaq |
| | Wemotaci | Mohawk* | |
| | Chisasibi | Doncaster* | |
| | Eastmain | Kahnawake* | |
| | Mistissini | Kanesatake* | |
| | Nemiscau | Innu | |
| | Oujé-Bougoumou | Betsiamites | |
| | Waskaganish | Essipit | |
| | Waswanipi | La Romaine | |
| | Wemindji | Lac-John* | |
| Huron-Wendat | Whapmagoostui | Mashteuiatsh | |
| | Wendake** | Maliotenam | |
| Micmac | Gaspé* | Matimekosh | |
| | Gesgapegiag | Mingan | |
| | Listuguj | Natashquan | |
| Malecite* | Cacouna* | Pakuashipi | |
| | Whitworth* | Uashat | |
| | | Naskapi | Kawawachikamach |

* Reserve/Village not used to calculate rates for 1988-1993, 1994-1998 and 1999-2004.

** Reserve/Village not used to calculate rates for 1988-1993 and 1994-1998.

3.2 CANCER INCIDENCE AND CANCER MORTALITY

The crude rate of cancer incidence and cancer mortality was calculated for Aboriginals living on reserves and in Northern villages and for all of Québec by using the ratio of the number of incident cases or deaths as the numerator and the corresponding population as the denominator. It should be noted that the incidence rate for all Aboriginal nations excludes all of the Malecite and Mohawk nations, the Hunter's Point and Rapid Lake reserves of the Algonquin nation, the Coucoucache reserve of the Atikamekw nation and the Lake John reserve of the Innu nation, due to unavailability of population data by age group and gender. The 1984-1987 period was also excluded from the calculation due to unavailability of data on Aboriginal populations in the 1986 Census.

These rates are calculated by age group for common sites and for all cancers, for men, women and both genders combined. For the purpose of comparison, the direct standardization method was used. To examine the evolution among Aboriginal groups, three periods were studied: 1988-1993, 1994-1998, and 1999-2004. In order to compare Aboriginal nations with the overall Québec population, the 1988-2004 period was calculated.

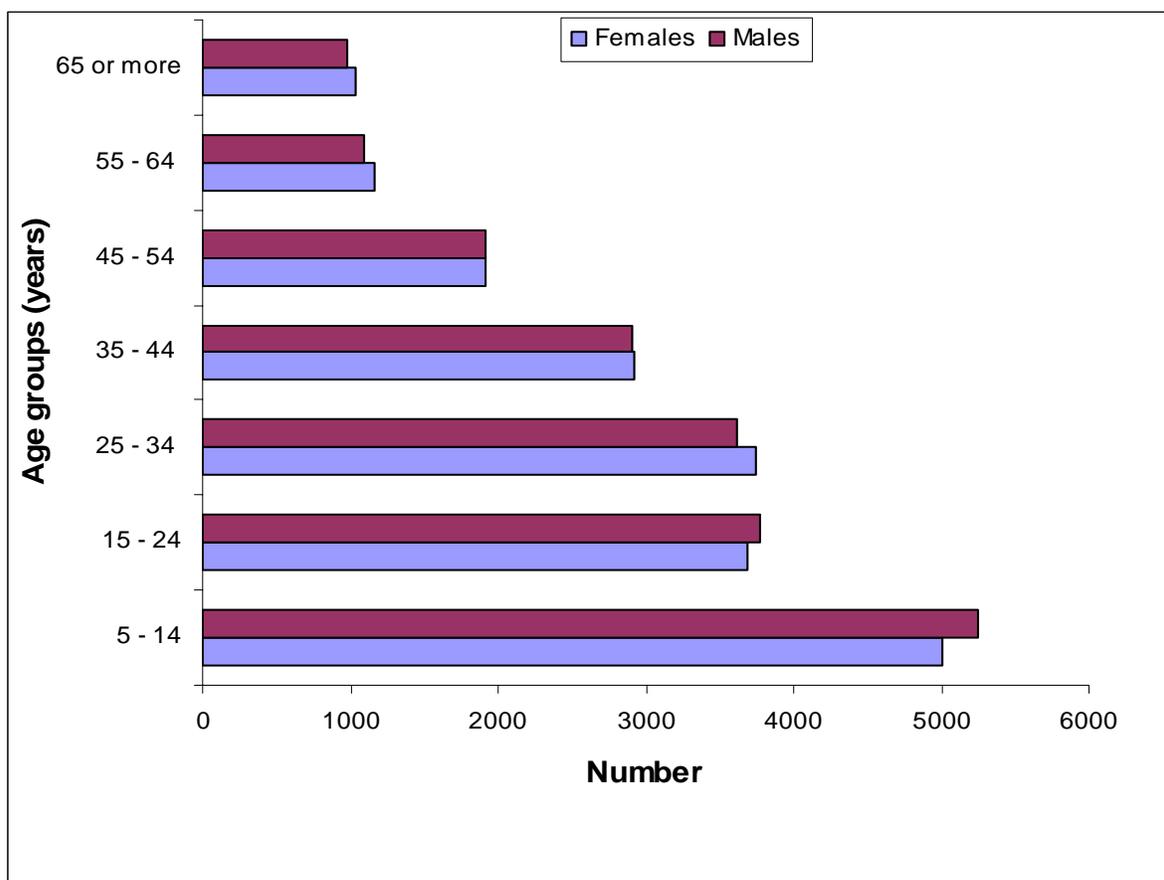
For comparisons, confidence intervals of 95% were also calculated to evaluate the statistical significance of the variation between the incidence of cancer and cancer mortality among Aboriginal groups and throughout Québec.

4 RESULTS

4.1 POPULATION

The Québec Aboriginal population shows a pyramidal age distribution; youth are more numerous and numbers decrease with age. In 2001, more than two-thirds of this population was under 35 years of age (69%) (Figure 1).

Figure 1 Aboriginal population in Québec living on reserves and in Northern villages in 2001, according to the 2001 Census



Source: 2001 Census.

Notes: 2,660 males and 2,540 females were less than 5 years of age.

Total Population: 44,230.

4.2 NEW CASES OF CANCER AND DEATHS BY CANCER

Between 1984 and 2004, based on area of residence in Indian Reserves and Northern villages, a total of 1,603 new cases of cancer (795 men and 808 women) were found in the Tumour File and 766 deaths by cancer (427 men and 339 women) in the mortality file for the Aboriginal population. Distribution by year is shown in Table 3. The numbers of new cases of cancer and deaths by cancer more than doubled between 1984 and 2004. The distribution of these new cases and deaths by age group and gender are shown in Table 4.

The numbers of new cases of cancer and deaths by cancer increase with age. More than half (56%) of cancer cases and more than two-thirds (68%) of deaths by cancer are among people 60 years of age and older, with a higher frequency among men than women.

As for the distribution of new cases according to cancer site, lung cancer is the leading cause, followed by colorectal cancer, breast cancer among women and prostate cancer. These four sites of cancer represent more than half of all cancer sites (Table 5). As for deaths by cancer, the ranking remains the same as their absolute importance, and represents about two-thirds of deaths by cancer.

The distribution of new cancer cases and deaths by cancer according to Aboriginal nation and gender is presented in Table 6.

Table 3 Distribution of the number of new cases of cancer and deaths from cancer among Aboriginals in Québec living on reserves and in Northern villages according to year and gender, 1984-2004

| Year | Overall | | Men | | Women | |
|--------------|----------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| | New cases (%) | Deaths (%) | New cases (%) | Deaths (%) | New cases (%) | Deaths (%) |
| 1984 | 43 (2.7) | 26 (3.4) | 15 (1.9) | 14 (3.3) | 28 (3.5) | 12 (3.5) |
| 1985 | 59 (3.7) | 21 (2.7) | 29 (3.6) | 12 (2.8) | 30 (3.7) | 9 (2.7) |
| 1986 | 65 (4.1) | 46 (6.0) | 33 (4.2) | 24 (5.6) | 32 (4.0) | 22 (6.5) |
| 1987 | 59 (3.7) | 24 (3.1) | 27 (3.4) | 14 (3.3) | 32 (4.0) | 10 (2.9) |
| 1988 | 62 (3.9) | 32 (4.2) | 34 (4.3) | 23 (5.4) | 28 (3.5) | 9 (2.7) |
| 1989 | 50 (3.1) | 32 (4.2) | 27 (3.4) | 19 (4.4) | 23 (2.8) | 13 (3.8) |
| 1990 | 55 (3.4) | 27 (3.5) | 27 (3.4) | 14 (3.3) | 28 (3.5) | 13 (3.8) |
| 1991 | 72 (4.5) | 24 (3.1) | 37 (4.7) | 16 (3.7) | 35 (4.3) | 8 (2.4) |
| 1992 | 67 (4.2) | 34 (4.4) | 31 (3.9) | 21 (4.9) | 36 (4.5) | 13 (3.8) |
| 1993 | 63 (3.9) | 28 (3.7) | 32 (4.0) | 14 (3.3) | 31 (3.8) | 14 (4.1) |
| 1994 | 75 (4.7) | 39 (5.1) | 41 (5.2) | 17 (4.0) | 34 (4.2) | 22 (6.5) |
| 1995 | 90 (5.6) | 33 (4.3) | 35 (4.4) | 18 (4.2) | 55 (6.8) | 15 (4.4) |
| 1996 | 66 (4.1) | 39 (5.1) | 31 (3.9) | 20 (4.7) | 35 (4.3) | 19 (5.6) |
| 1997 | 73 (4.6) | 35 (4.6) | 36 (4.5) | 21 (4.9) | 37 (4.6) | 14 (4.1) |
| 1998 | 87 (5.4) | 47 (6.1) | 45 (5.7) | 25 (5.9) | 42 (5.2) | 22 (6.5) |
| 1999 | 89 (5.6) | 45 (5.9) | 45 (5.7) | 28 (6.6) | 44 (5.4) | 17 (5.0) |
| 2000 | 98 (6.1) | 53 (6.9) | 47 (5.9) | 24 (5.6) | 51 (6.3) | 29 (8.6) |
| 2001 | 112 (7.0) | 40 (5.2) | 62 (7.8) | 24 (5.6) | 50 (6.2) | 16 (4.7) |
| 2002 | 100 (6.2) | 49 (6.4) | 58 (7.3) | 28 (6.6) | 42 (5.2) | 21 (6.2) |
| 2003 | 114 (7.1) | 45 (5.9) | 56 (7.0) | 23 (5.4) | 58 (7.2) | 22 (6.5) |
| 2004 | 104 (6.5) | 47 (6.1) | 47 (5.9) | 28 (6.6) | 57 (7.1) | 19 (5.6) |
| Total | 1 603 (100.0) | 766 (100.0) | 795 (100.0) | 427 (100.0) | 808 (100.0) | 339 (100.0) |

Table 4 Distribution of the number of new cases of cancer and deaths from cancer among Aboriginals in Québec living on reserves and in Northern villages according to age group and gender, 1988-2004

| Age group | Overall | | Men | | Women | |
|------------------|----------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| | New cases (%) | Deaths (%) | New cases (%) | Deaths (%) | New cases (%) | Deaths (%) |
| 0 - 19 years | 43 (3.1) | 9 (1.4) | 22 (3.2) | 6 (1.7) | 21 (3.1) | 3 (1.0) |
| 20 - 44 years | 201 (14.6) | 48 (7.4) | 63 (9.1) | 18 (5.0) | 138 (20.1) | 30 (10.5) |
| 45 - 59 years | 366 (26.6) | 149 (23.0) | 168 (24.3) | 67 (18.5) | 198 (28.9) | 82 (28.7) |
| 60 years or more | 767 (55.7) | 443 (68.3) | 438 (63.4) | 272 (74.9) | 329 (48.0) | 171 (59.8) |
| Total | 1 377 (100.0) | 649 (100.0) | 691 (100.0) | 363 (100.0) | 686 (100.0) | 286 (100.0) |

Table 5 Distribution of the number of new cases of cancer and deaths from cancer among Aboriginals in Québec living on reserves and in Northern villages according to cancer site and gender, 1988-2004

| Cancer site | New cases (%) | Deaths (%) |
|------------------------|---------------|------------|
| Both genders | | |
| Lung | 319 (23.2) | 256 (39.4) |
| Colorectal | 181 (13.1) | 52 (8.0) |
| Breast (women) | 119 (8.6) | 26 (4.0) |
| Prostate | 88 (6.4) | 28 (4.3) |
| Kidney | 85 (6.2) | 23 (3.5) |
| Cervix | 46 (3.3) | 15 (2.3) |
| Non-Hodgkin's Lymphoma | 46 (3.3) | 11 (1.7) |
| Pancreas | 30 (2.2) | 21 (3.2) |
| Bladder | 28 (2.0) | 6 (0.9) |
| Brain | 26 (1.9) | 15 (2.3) |
| Stomach | 25 (1.8) | 16 (2.5) |
| Liver | 25 (1.8) | 23 (3.5) |
| Leukemia | 24 (1.7) | 16 (2.5) |
| Ovary | 23 (1.7) | 11 (1.7) |
| Body of Uterus | 20 (1.5) | 1 (0.2) |
| Other sites | 292 (21.2) | 129 (19.9) |

Table 5 Distribution of the number of new cases of cancer and deaths from cancer among Aboriginals in Québec living on reserves and in Northern villages according to cancer site and gender, 1988-2004 (continued)

| Cancer site | New cases (%) | Deaths (%) |
|------------------------|---------------|------------|
| Men | | |
| Lung | 188 (27.2) | 154 (42.4) |
| Prostate | 88 (12.7) | 28 (7.7) |
| Colorectal | 81 (11.7) | 28 (7.7) |
| Kidney | 46 (6.7) | 12 (3.3) |
| Non-Hodgkin's Lymphoma | 26 (3.8) | 6 (1.7) |
| Bladder | 24 (3.5) | 6 (1.7) |
| Liver | 21 (3.0) | 16 (4.4) |
| Pancreas | 19 (2.7) | 16 (4.4) |
| Brain | 17 (2.5) | 9 (2.5) |
| Stomach | 15 (2.2) | 12 (3.3) |
| Leukemia | 11 (1.6) | 9 (2.5) |
| Other sites | 155 (22.4) | 67(18.5) |
| Women | | |
| Lung | 131 (19.1) | 102 (35.7) |
| Breast | 119 (17.3) | 26 (9.1) |
| Colorectal | 100 (14.6) | 24 (8.4) |
| Cervix | 46 (6.7) | 15 (5.2) |
| Kidney | 39 (5.7) | 11 (3.8) |
| Ovary | 23 (3.4) | 11 (3.8) |
| Body of Uterus | 20 (2.9) | 1 (0.3) |
| Non-Hodgkin's Lymphoma | 20 (2.9) | 5 (1.7) |
| Leukemia | 13 (1.9) | 7 (2.4) |
| Pancreas | 11 (1.6) | 5 (1.7) |
| Stomach | 10 (1.5) | 4 (1.4) |
| Brain | 9 (1.3) | 6 (2.1) |
| Liver | 4 (0.6) | 7 (2.4) |
| Bladder | 4 (0.6) | - |
| Other sites | 137 (20.0) | 62 (21.7) |

Table 6 **Distribution of the number of new cases of cancer and deaths from cancer among Aboriginals in Québec living on reserves and in Northern villages according to nation and gender, 1988-2004**

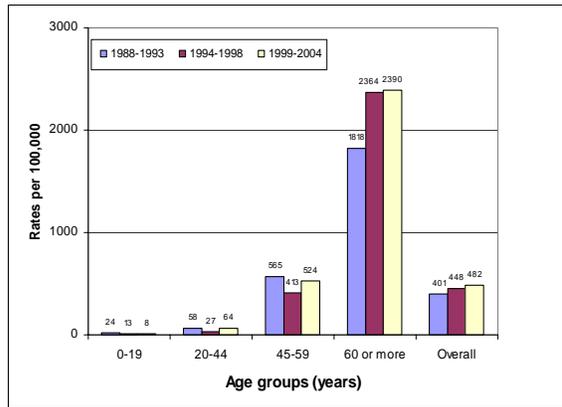
| Nation | Total | | Men | | Women | |
|--------------|---------------|-------------|-------------|-------------|-------------|-------------|
| | New cases | Deaths | New cases | Deaths | New cases | Deaths |
| Abenaki | 31 (2.3) | 17 (2.6) | 18 (2.6) | 10 (2.8) | 13 (1.9) | 7 (2.4) |
| Algonquin | 87 (6.3) | 28 (4.3) | 42 (6.1) | 13 (3.6) | 45 (6.6) | 15 (5.2) |
| Atikamekw | 106 (7.7) | 51 (7.9) | 54 (7.8) | 29 (8.0) | 52 (7.6) | 22 (7.7) |
| Cree | 307 (22.3) | 138 (21.3) | 155 (22.4) | 79 (21.8) | 152 (22.2) | 59 (20.6) |
| Huron-Wendat | 63 (4.6) | 19 (2.9) | 42 (6.1) | 14 (3.9) | 21 (3.1) | 5 (1.7) |
| Inuit | 268 (19.5) | 158 (24.3) | 129 (18.7) | 89 (24.5) | 139 (20.3) | 69 (24.1) |
| Micmac | 77 (5.6) | 36 (5.5) | 31 (4.5) | 20 (5.5) | 46 (6.7) | 16 (5.6) |
| Innu | 429 (31.2) | 196 (30.2) | 213 (30.8) | 105 (28.9) | 216 (31.5) | 91 (31.8) |
| Naskapi | 9 (0.7) | 6 (0.9) | 7 (1.0) | 4 (1.1) | 2 (0.3) | 2 (0.7) |
| All nations | 1,377 (100.0) | 649 (100.0) | 691 (100.0) | 363 (100.0) | 686 (100.0) | 286 (100.0) |

4.3 **SPECIFIC AND STANDARDIZED RATES OF CANCER INCIDENCE AND CANCER MORTALITY AMONG ABORIGINALS IN QUÉBEC LIVING ON RESERVES AND IN NORTHERN VILLAGES AND THAT OF THE GENERAL POPULATION OF QUÉBEC**

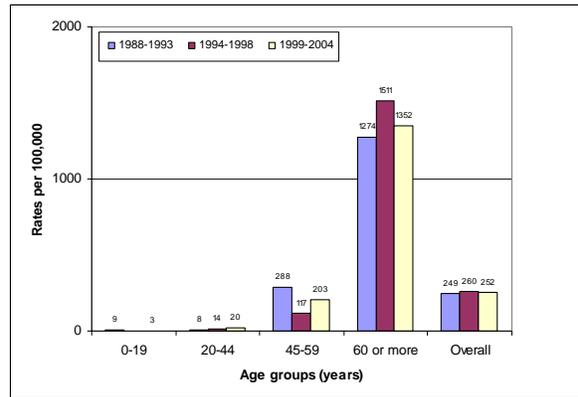
Cancer incidence and cancer mortality rates between 1988 and 2004 increased with age and, depending on the period, particularly among those 60 and older, as much among men as women (Figure 2). However, the increase during this period was not statistically significant.

Figure 2 Specific and standardized rates of cancer incidence and cancer mortality per 100,000 persons among Aboriginals in Québec living on reserves and in Northern villages according to age group, gender and period, 1988-2004

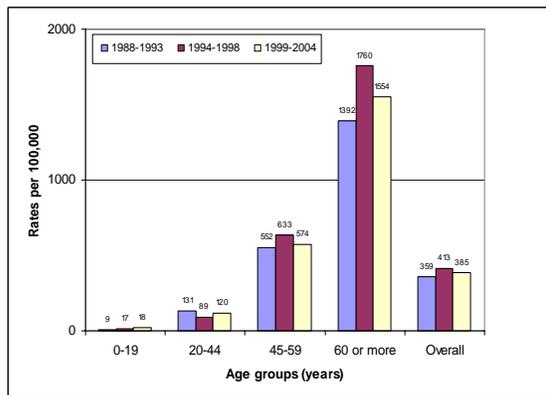
a) Incidence - men



b) Mortality - men



c) Incidence - women



d) Mortality - women

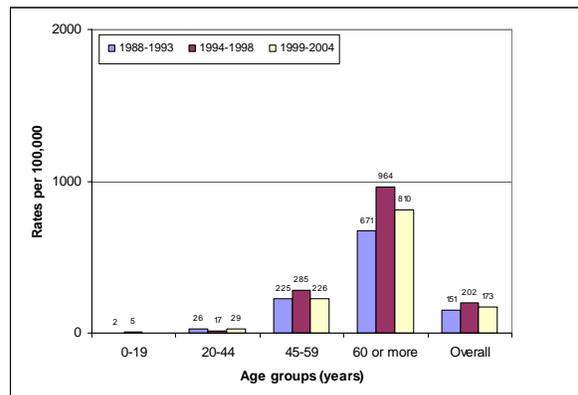


Table 7 shows cancer incidence and cancer mortality rates in Québec and among Aboriginal nations living on reserves and in Northern villages of Québec by gender between 1988 and 2004. Overall, for all causes, Aboriginals show rates comparable to all of Québec, both for cancer incidence and mortality by cancer. However, these rates vary according to Aboriginal nation and type of cancer. The Atikamekw, Huron-Wendats and Innu have incidence rates higher than all of Québec, while the Algonquin, Cree and Naskapi show lower cancer rates. As for mortality, the Atikamekw, Inuit and Innu have rates higher than all of Québec, while the Algonquin and Cree show a lower cancer rate. Abenaki women also have a lower incidence rate than women throughout Québec.

As for the rates according to cancer site (Table 8), Aboriginal men show a higher incidence rate than men across Québec for liver, lung and kidney cancer. Among Aboriginal women, the rate is higher than for women throughout Québec for colorectal cancer, lung cancer, cervical cancer, kidney cancer and other types of cancer. In terms of mortality, Aboriginal men show a higher rate than Québec men of liver cancer while Aboriginal women show a higher rate than Québec women of lung, cervical and other types of cancer.

On the other hand, Aboriginal men living on reserves and in Northern villages show significantly lower rates of prostate and bladder cancer and leukemia as well as lower mortality rates for colorectal cancer, non-Hodgkin's lymphoma and leukemia. For women, the incidence rate for breast, uterine, bladder and brain cancer and for leukemia, and the mortality rates for colorectal cancer, stomach, pancreatic, breast, bladder and brain cancers are significantly lower when compared to women throughout Québec.

Table 7 Standardized rates of cancer incidence and cancer mortality per 100,000 persons among Aboriginals in Québec living on reserves and in Northern villages according to nation and gender and in the Québec general population according to gender, 1988-2004

| Nation | Total | Men | Women |
|---------------------------|-----------------------|------------------------|-----------------------|
| Incidence | | | |
| Abenaki | 302.8 (195.7-409.8) | 470.6 (253.0-688.2) | 220.4 (98.9-342.0)- |
| Algonquin | 252.5 (197.3-307.6)- | 250.5 (170.5-330.6)- | 253.7 (177.6-329.8)- |
| Atikamekw | 849.7 (673.0-1026.4)+ | 819.7 (581.8-1057.7)+ | 856.9 (602.9-1110.8)+ |
| Cree | 329.8 (291.2-368.5)- | 348.2 (291.6-404.8)- | 311.7 (259.0-364.4) |
| Huron-Wendat | 657.5 (492.6-822.4)+ | 1042.1 (715.3-1369.0)+ | 398.5 (226.2-570.8) |
| Inuit | 451.7 (392.1-511.2) | 483.6 (392.3-575.0) | 431.2 (352.0-510.4) |
| Micmac | 402.8 (311.0-494.6) | 377.3 (241.3-513.2) | 435.2 (307.4-563.0) |
| Innu | 527.0 (475.2-578.7)+ | 564.5 (486.3-642.7)+ | 490.1 (422.0-558.1)+ |
| Naskapi | 225.9 (66.7-385.2)- | 308.7 (66.8-550.7) | 113.5 (0.0-285.1)- |
| All nations | 414.2 (391.3-437.2) | 447.9 (413.0-482.7) | 385.0 (354.7-415.3) |
| Québec general population | 404.0 (402.9-405.0) | 473.1 (471.3-474.8) | 356.5 (355.1-357.9) |
| Mortality | | | |
| Abenaki | 166.6 (87.1-246.1) | 258.7 (98.2-419.3) | 126.5 (31.2-221.8) |
| Algonquin | 84.7 (52.4-117.0)- | 90.0 (39.4-140.5)- | 82.9 (40.2-125.5)- |
| Atikamekw | 438.2 (310.3-566.0)+ | 483.9 (298.3-669.4)+ | 374.0 (206.8-541.2) |
| Cree | 163.5 (135.5-191.5)- | 194.3 (150.9-237.7)- | 131.2 (96.2-166.2) |
| Huron-Wendat | 208.4 (113.7-303.1) | 381.5 (177.0-586.0) | 93.1 (11.1-175.0) |
| Inuit | 304.3 (253.6-355.1)+ | 365.7 (284.4-447.0)+ | 252.5 (188.7-316.3)+ |
| Micmac | 201.3 (134.7-267.9) | 253.0 (140.4-365.6) | 162.1 (81.8-242.4) |
| Innu | 259.6 (222.4-296.8)+ | 290.6 (233.7-347.6) | 229.3 (181.0-277.6)+ |
| Naskapi | 158.9 (23.0-294.7) | 189.4 (0.0-383.4) | 113.5 (0.0-285.1) |
| All nations | 212.1 (195.2-228.9) | 252.6 (225.9-279.4) | 174.9 (153.9-195.9) |
| Québec general population | 203.0 (202.2-203.7) | 252.8 (251.5-254.1) | 165.6 (164.6-166.5) |

+ Rates are significantly higher than those of the Québec general population.

- Rates are significantly lower than those of the Québec general population.

Table 8 Standardized rates of cancer incidence and cancer mortality per 100,000 persons among Aboriginals in Québec living on reserves and in Northern villages and in the Québec general population according to cancer site and gender, 1988-2004

| | Aboriginals in Québec living on reserves and in Northern villages | | Québec general population | |
|------------------------------|---|---------------------|---------------------------|---------------------|
| Overall – Cancer site | | | | |
| | Incidence | Mortality | Incidence | Mortality |
| Stomach | 7.8 (4.6-11.0) | 5.4 (2.7-8.1) | 10.4 (10.3-10.6) | 7.7 (7.5-7.8) |
| Colorectal | 56.5 (47.9-65.0) | 16.8 (12.1-21.6)- | 54.3 (53.9-54.7) | 24.6 (24.3-24.9) |
| Liver | 7.7 (4.5-10.8)+ | 7.8 (4.5-11.1)+ | 4.1 (4.0-4.2) | 3.9 (3.8-4.0) |
| Pancreas | 9.3 (5.8-12.7) | 7.2 (4.1-10.4) | 10.7 (10.5-10.8) | 10.0 (9.8-10.1) |
| Lung | 106.0 (94.1-117.9)+ | 86.8 (75.9-97.7)+ | 71.9 (71.4-72.3) | 59.8 (59.4-60.2) |
| Breast cancer among women | - | - | - | - |
| Cervix | - | - | - | - |
| Body of uterus | - | - | - | - |
| Ovary | - | - | - | - |
| Prostate | - | - | - | - |
| Bladder | 9.5 (5.9-13.1)- | 2.1 (0.4-3.9)- | 20.6 (20.4-20.9) | 4.5 (4.4-4.6) |
| Kidney | 24.5 (19.0-29.9)+ | 7.2 (4.1-10.2) | 11.9 (11.7-12.1) | 4.4 (4.3-4.5) |
| Brain | 4.7 (2.7-6.8)- | 3.3 (1.5-5.2) | 7.0 (6.9-7.2) | 5.2 (5.1-5.3) |
| Non-Hodgkin's Lymphoma | 12.4 (8.6-16.2)- | 3.4 (0.4-6.5)- | 16.2 (16.0-16.5) | 7.0 (6.9-7.1) |
| Leukemia | 4.9 (2.6-7.1)+ | 3.6 (1.6-5.6)- | 11.6 (11.4-11.8) | 6.5 (6.4-6.6) |
| Other sites | 84.0 (73.8-94.2) | 50.2 (42.0-58.4)+ | 68.6 (68.2-69.1) | 36.0 (35.7-36.4) |
| All sites | 414.2 (391.3-437.2) | 212.1 (195.2-228.9) | 404.0 (402.9-405.0) | 203.0 (202.2-203.7) |

Table 8 Standardized rates of cancer incidence and cancer mortality per 100,000 persons among Aboriginals in Québec living on reserves and in Northern communities and in the Québec general population according to cancer site and gender, 1988-2004 (continued)

| | Aboriginals in Québec living on reserves and in Northern villages | | Québec general population | |
|--------------------------|---|---------------------|---------------------------|---------------------|
| Men – Cancer site | | | | |
| Stomach | 10.3 (4.9-15.7) | 8.4 (3.5-13.2) | 14.7 (14.4-15.0) | 10.6 (10.4-10.9) |
| Colorectal | 52.3 (40.5-64.2) | 20.0 (12.4-27.6)- | 64.0 (63.3-64.6) | 28.8 (28.3-29.2) |
| Liver | 14.2 (7.9-20.5)+ | 11.6 (5.7-17.4)+ | 6.2 (6.0-6.4) | 5.4 (5.2-5.6) |
| Pancreas | 11.9 (6.3-17.4) | 11.3 (5.6-17.0) | 12.2 (11.9-12.4) | 11.4 (11.1-11.6) |
| Lung | 131.5 (112.2-150.8)+ | 109.9 (92.2-127.6) | 107.2 (106.3-108.0) | 92.1 (91.3-92.9) |
| Prostate | 64.8 (51.1-78.6)- | 21.1 (13.2-29.0) | 91.7 (90.9-92.5) | 23.6 (23.2-24.0) |
| Bladder | 16.7 (9.8-23.6)- | 4.4 (0.8-8.0) | 34.9 (34.4-35.4) | 7.1 (6.8-7.3) |
| Kidney | 27.9 (19.5-36.4)+ | 7.8 (3.2-12.4) | 16.0 (15.6-16.3) | 6.0 (5.8-6.2) |
| Brain | 6.2 (2.8-9.7) | 4.7 (1.3-8.1) | 8.4 (8.1-8.6) | 6.3 (6.1-6.5) |
| Non-Hodgkin's Lymphoma | 15.3 (9.1-21.4) | 3.6 (0.6-6.7)- | 19.1 (18.7-19.4) | 8.2 (7.9-8.4) |
| Leukemia | 4.2 (1.4-7.1)- | 4.2 (1.1-7.3)- | 14.4 (14.1-14.7) | 8.2 (7.9-8.4) |
| Other sites | 92.5 (77.0-107.9) | 49.3 (37.6-60.9) | 84.4 (83.7-85.2) | 45.1 (44.6-45.7) |
| All sites | 447.9 (413.0-482.7) | 252.6 (225.9-279.4) | 473.1 (471.3-474.8) | 252.8 (251.5-254.1) |

Table 8 Standardized rates of cancer incidence and cancer mortality per 100,000 persons among Aboriginals in Québec living on reserves and in Northern villages and in the Québec general population according to cancer site and gender, 1988-2004 (continued)

| | Aboriginals in Québec living on reserves and in Northern villages | | Québec general population | |
|----------------------------|---|---------------------|---------------------------|---------------------|
| Women – Cancer site | | | | |
| Stomach | 5.5 (1.9-9.2) | 2.6 (0.0-5.2)- | 7.1 (6.9-7.3) | 5.3 (5.2-5.5) |
| Colorectal | 60.6 (48.3-72.9)+ | 14.0 (8.2-19.8)- | 46.7 (46.2-47.2) | 21.4 (21.1-21.7) |
| Liver | 1.5 (0.0-3.1) | 4.3 (1.0-7.6) | 2.5 (2.4-2.6) | 2.7 (2.6-2.9) |
| Pancreas | 6.8 (2.6-11.0) | 3.4 (0.4-6.5)- | 9.5 (9.2-9.7) | 8.8 (8.6-9.0) |
| Lung | 82.4 (67.9-96.8)+ | 65.3 (52.3-78.3)+ | 45.1 (44.6-45.5) | 35.2 (34.8-35.7) |
| Breast | 65.7 (53.4-78.0)- | 14.3 (8.5-20.0)- | 102.8 (102.1-103.6) | 30.0 (29.6-30.4) |
| Cervix | 21.3 (14.8-27.9)+ | 8.0 (3.7-12.2)+ | 8.2 (7.9-8.4) | 2.0 (1.9-2.1) |
| Body of Uterus | 9.8 (5.2-14.3)- | 0.3 (0.0-1.0) | 17.4 (17.1-17.7) | 2.2 (2.1-2.3) |
| Ovary | 12.6 (7.2-18.0) | 6.8 (2.6-11.0) | 14.2 (13.9-14.5) | 7.9 (7.7-8.1) |
| Bladder | 2.7 (0.0-5.4)- | 0- | 9.5 (9.3-9.7) | 2.5 (2.4-2.6) |
| Kidney | 21.3 (14.3-28.3)+ | 6.6 (2.6-10.6) | 8.7 (8.4-8.9) | 3.2 (3.0-3.3) |
| Brain | 3.3 (1.0-5.6)- | 2.1 (0.4-3.9)- | 5.8 (5.7-6.0) | 4.2 (4.1-4.4) |
| Non-Hodgkin's Lymphoma | 9.8 (5.2-14.3) | 3.4 (0.4-6.5) | 13.7 (13.5-14.0) | 6.0 (5.8-6.2) |
| Leukemia | 5.5 (2.1-8.8)- | 3.0 (0.5-5.5) | 9.3 (9.1-9.6) | 5.2 (5.0-5.3) |
| Other sites | 76.2 (62.7-89.8)+ | 40.7 (30.3-51.1)+ | 56.0 (55.4-56.5) | 28.8 (28.4-29.2) |
| All sites | 385.0 (354.7-415.3) | 174.9 (153.9-195.9) | 356.5 (355.1-357.9) | 165.6 (164.6-166.5) |

- + Rates are significantly higher than those of the Québec general population.
- Rates are significantly lower than those of the Québec general population.

5 DISCUSSION

5.1 RESULTS

The first goal of this study was to identify new cases of cancer and deaths by cancer among Québec Aboriginals who live on reserves or in Northern villages, in order to monitor cancers among these populations. In the absence of variables to allow for the ethnic identification of people in the Québec Tumour File and the mortality file, this study examined the possibility of using area of residence to make this identification. Results have shown that information on area of residence in these administrative files can be used to monitor cancers among Aboriginal populations living on reserves and in Northern villages. Indeed, we were able to identify 2,218 new cases of cancer from the Tumour File and 1,031 deaths by cancer from the deaths file, before applying exclusion criteria.

From 1984 to 2004, the number of new cases and number of deaths by cancer among Québec Aboriginals living on reserves and in Northern villages has doubled. The most frequent cancers are lung and colorectal cancers. The annual increase in cancer cases and the predominance of these two cancers was already observed between 1971 and 1984 among the Québec Inuits (1).

The results also show that cancer incidence and cancer mortality rates among Québec Aboriginals living on reserves and in Northern villages equal or even exceed those observed for all of Québec, although the difference is not statistically significant, the rates vary according to Aboriginal nations. The Attikamek, Huron-Wendat, Innu and Inuit show high rates while the Algonquin, Cree and Naskapi show lower rates.

The cancer incidence rates are significantly higher among Québec Aboriginals than for all of Québec for liver, lung and kidney cancers for men as well as colorectal, lung and cervical cancers and other sites for women. In terms of mortality, Aboriginal men in Québec show a significantly higher rate for liver cancer. Among Québec Aboriginal women, the mortality rates are significantly higher for lung, cervical and other cancer sites.

Aboriginals, compared to the Québec general population, show lower incidence rates for many cancers, notably for breast among women, as well as cervical, prostate, bladder and brain cancers and leukemia. Furthermore, they show lower mortality rates for colorectal, stomach, pancreas, breast among women, bladder and brain cancers as well as non-Hodgkin's lymphoma and leukemia.

5.2 COMPARISON WITH THE RESULTS OF OTHER STUDIES

Many Canadian studies have analyzed cancer patterns in Aboriginals. While they have used different methodologies to identify Aboriginals and the target population (Aboriginals living on reserves or the total Aboriginal population), these studies have found that Aboriginals show lower cancer rates than the general population (3, 7-9, 13, 14, 16). However, our results show that cancer rates for Québec Aboriginals living on reserves or in Northern villages equal those of the general population of Québec. This does not necessarily contradict previous studies, because the period covered here is very recent compared to earlier studies.

The incidence and mortality excess for certain cancer sites among Aboriginals have also been found in a few Canadian studies while in others a deficit was reported. Indeed, in Canada, Aboriginals living on reserves experience higher mortality by liver illness linked to the excessive consumption of alcohol (17, 18). Kidney and cervical cancers are very widespread in Aboriginal populations as evidenced by the high incidence rate seen among Aboriginals in Ontario between 1968 and 1991 (8), among those in Saskatchewan (cervical cancer) between 1967 and 1986 (4), among Aboriginals in north western Ontario (kidney cancer) between 1972 and 1981 (13) as well as those living on reserves in Manitoba between 1970 and 1979 (16). An increased risk of cervical cancer mortality was reported among Aboriginal women in British Columbia (11, 19) and among First Nations women in Ontario (8). Band *et al.* (1991) associate this increased risk with low participation in the provincial screening program due to socio-cultural barriers (19). On the other hand, lung and colorectal cancer mortality rates were lower among Aboriginals between 1953 and 1978 and among British Columbia Indians between 1964 and 1973. The incidence rates for these sites were lower among North American Aboriginals living in Alaska, New York State, Western Washington, Ontario and Manitoba (between 1955 and 1984) as well as for Manitoba Indians (between 1970 and 1979) (7, 11, 14, 16), though it is reported that lung cancer rates are increasing (4, 7).

In the United States, an elevated mortality risk was reported between 1990-2001 for kidney cancer among men as well as liver and stomach cancer for both genders among American Indians and Alaskan Aboriginals combined (12). American Indians also experience an increased risk of mortality by cervical and gall bladder cancers (10, 20). In other studies, American Aboriginals in Western Washington show an increased risk of cervical cancer incidence (21) and Alaskan Aboriginals, an elevated risk of cancer incidence and cancer mortality for many other cancer sites, notably mouth, colorectal, gall bladder, pancreas, cervix and kidney (20). Recent data comparing Indians from Alaska and New Mexico to the overall American population show an overall higher rate of the incidence of cancer, particularly mouth, throat, stomach, colorectal, gall bladder, pancreas, lung, kidney and breast cancer among women (21). These data are similar to our findings for many cancers, and covers a period equivalent to our study.

5.3 INTERPRETATION

5.3.1 High-risk cancers

Changes in the lifestyle habits of Québec Aboriginals living on reserves and in Northern villages may explain the increased rates of cancer incidence and mortality in these populations.

Exposure to cigarette smoke is implied in the etiology of many cancers, notably lung, colorectal (22) and kidney cancer. Traditional tobacco, considered sacred among Canadian Aboriginals, is traditionally more consumed (1, 23). The percentage of Canadian Aboriginal smokers was estimated at 62% in 1997 (24). Among the Québec Cree, the percentage was estimated at 41% in 1991 for those 15 years of age or older (45.7% of men and 37.0% of women) (25) and 33.7% in 2000-2001 and in 2003 for people 12 years of age and older (26). Among Inuit, in 1992 the proportion of smokers was estimated at 67.7% for those 15 years of

age and older: 70.9% of women and 64.6% of men (27). This proportion reached 77% in 2004: 80% of women and 74% of men (28).

Food, obesity, diabetes and lack of physical activity are among the factors associated with colorectal cancer (29, 30). In 1991, it was estimated that about 47.5% of Cree between 18 and 74 years of age were obese (56.9% of women and 38.4% of men), and 34% were overweight (25). In 2003, these proportions were estimated at 51.2% and 32.8% for those 18 years and older (26). Among Inuit, in 1992, the prevalence of obesity was estimated at 19% for the 18-to-74 age group (31). Moreover, according to the 1991 Cree survey, 70% of those 15 years and older were sedentary, and diabetes affected 7.4% of the population in the 18-to-74 age group (25). This last figure reached 13% in 2002 (32). In addition, the prevalence of diabetes among Québec Aboriginals 18 years and older living off reserve was estimated at 6.4% (33). Also, the literature shows that in Hawaii, immigrants coming from populations at low risk for developing breast cancer among women, prostate cancer and colorectal cancer showed, less than a generation after their arrival, higher rates of colorectal cancers while the rates remained low for other sites of cancer until the following generation. These results suggest that recent changes in risk factors have more influence on colorectal cancers than the other sites (34).

Alcohol is also a factor associated with colorectal (22) and liver cancer (35). Studies showed a high death risk from diseases related to excessive alcohol consumption among Aboriginal populations (17, 18). The proportions of habitual and occasional consumers were estimated at 26.7% and 22.2% respectively among Cree 15 years of age or older in 1991 (25), and were estimated at 41.2% and 19.1% among Inuit 15 years of age or older in 1992 (27). In 2004, these proportions were estimated at 50.1% and 26.8% among Inuit 15 years of age or older (36).

The Human Papillomavirus (HPV) infection is now recognized as a necessary cause of cervical cancer (37). Having several children at a very young age could be associated with this cancer (8). During the 1999-2003 period, the pregnancy rate of 14 to 17 year old girls was estimated at 85.6% among Inuit and 57.5% among Cree, compared to a rate of 18.2% for all of Québec.

With early screening and Pap tests, cervical cancer, once a widespread and fatal illness, is now rare (38). In the absence of cervical abnormalities screening, an increased risk of incidence and mortality is observed. The percentage of Cree women 18 to 69 years of age having had a Pap test within a three-year period was estimated at 67.9% in 2003. The proportion of Inuit women 15 years of age or older having had this test in the two years prior to the investigation in 1992 was estimated at 75.9% (27). These proportions are comparable to the general population of Québec, which was estimated at 71.2%.

Low economic status is associated with many cancers, and Aboriginal populations are very deprived. In Canada, Aboriginals on reserves are less educated (24). In Québec, it is estimated that 56.1% of Cree and 55% of Inuit over the age of 25 have less than a high school diploma, compared to 31.3% for all of Québec (26).

5.3.2 Rare cancers

Many explanations are advanced for the low incidence of other cancers; one of the most probable is competing causes of death. People may in fact die of another cause such as infection, trauma, diabetes, etc. before developing a cancer (17, 18, 39). Aboriginals living on reserves have a very high mortality rate, particularly those under 40 (17). In Québec, life expectancy at birth, estimated for the 2000-2003 period, was 63.3 years for the Inuit and 77.4 years for the Cree; these two nations being ahead of other groups in terms of premature mortality. For example, the low incidence of prostate cancer, which occurs at a much older age, can be explained by significant premature mortality due to other causes. It should also be mentioned that the PSA screening test is a major determinant for a large number of prostate cancer cases detected in the Québec population. If found that the Aboriginal population uses this test less frequently, the result will show a lower proportion of prostate cancers detected compared to the rest of Québec. Another plausible explanation is that these populations are protected by their traditional diet. Indeed, a study based on autopsies between 1990 and 1994 inclusively examined the prevalence of in situ prostate cancers among the Greenland Inuit. The results of this study showed that they did not have latent carcinomas in their prostates. The authors suggested that this was due to a traditional diet rich in omega-3 fatty acids and selenium (40). The same factor could explain the low incidence of bladder cancer among Aboriginals both in Québec and worldwide, despite high levels of exposure to cigarette smoke, which is a risk factor strongly associated with bladder cancer.

5.4 STRENGTHS AND LIMITATIONS OF THE DATA

This study examined patterns in Aboriginals living on reserves and in Northern villages only, which limits the generalization of the results to the entire Aboriginal population in Québec. Not all Aboriginals live on reserves. The proportion of Aboriginal people living off reserve and who are affected by cancer is unknown. In addition, the observed rates (incidence and mortality) could be underestimated if people return to their home village once they have cancer. Also, for medical consultation or care, many Aboriginals leave Québec, while others come from elsewhere to be treated in Québec. In addition, Métis and non-Aboriginals also live on reserves and in Northern villages. The percentage of Métis is not yet known. The proportion of Caucasians employed in the services area is estimated at 5% in the Cree and Inuit territories. This percentage may be smaller on other reserves which are located close to non-Aboriginal municipalities that are well equipped with services.

The Aboriginal population is heterogeneous (Cree, Inuit, etc.). The aggregate data analysis masks particular patterns or specific environmental factors for each population. Due to the limited size of the population, it is difficult to show significant trends for each nation. The addition of future years of data, as they become available, will allow for a refinement of the analysis.

We are also confronted with the census under coverage of the populations living on reserves. Small populations are rounded to values of 0 or 5. Similarly, not all reserves take part in the Canadian Census. For example, the 2001 census population data were available only for 49 out of 58 reserves. The missing reserves also receive medical care and declare

their deaths to the Québec civil registry. Consequently, many communities have been excluded from estimates of cancer incidence and cancer mortality. However, we believe that there is no bias related to this exclusion.

Despite its limitations, our data are indicative and reflect cancer incidence among Aboriginals, as confirmed elsewhere in the world. Our findings are similar to results previously published regarding Aboriginal populations. These results indicate a low incidence of cancers of the prostate, bladder and breast for women, and an increased risk of kidney, lung and cervical cancers.

6 CONCLUSION

The Aboriginal populations of Québec, who just 20 years ago were scarcely affected by cancer, today have high rates of incidence and mortality for many sites. With the low utilization of preventive measures and health services, such populations have limited means to fight this terrible illness.

Moreover, Aboriginal populations are deprived on the socio-economic scale with characteristics and health problems such as obesity, alcoholism, low education, smoking and diabetes, which are also among the risk factors for cancer.

Thus governmental organizations involved in the fight against cancer among Québec Aboriginals face many challenges, such as how to reduce health inequalities, increase access to health care and screening, and address poverty and sociocultural barriers.

Finally, this study shows the feasibility of an approach that may be used as an alternative and systematically to monitor cancer among Aboriginals in Québec and possibly other Canadian provinces if they have similar geographic codes in their databases. Population data deserve special investigation. Population estimates are therefore necessary, be it through the addition of other sources or by using modeling to correct the under coverage, and by the addition of reserves for which there is no census data available.

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