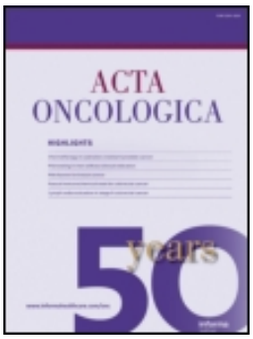

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# Cancer in Circumpolar Inuit: Background information for cancer patterns in Canadian Inuit

Leslie A. Gaudette, Sharon Freitag, Rose Dufour, Maureen Baikie, Ru-Nie Gao & Miriam Wideman

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# CANCER IN CIRCUMPOLAR INUIT

## Background information for cancer patterns in Canadian Inuit

LESLIE A. GAUDETTE, SHARON FREITAG, ROSE DUFOUR, MAUREEN BAIKIE, RU-NIE GAO and MIRIAM WIDEMAN

**The cancer pattern among Inuit in the Circumpolar area is remarkably different from those of other populations in the world. The current paper summarizes the most important risk factors in Canadian Inuit residing in the Northwest Territories, northern Québec (Nunavik) and Labrador, particularly during the time period 1969–1988 covered by the study. Factors considered include: the geographic area and physical environment; population and human environment, including fertility and life expectancy; lifestyle and diet, including tobacco and alcohol use; other lifestyle factors, and health conditions; and health services and cultural accessibility. Development of the cancer registry and population databases supporting the analysis of cancer rates is described. The information in the present paper is needed to interpret cancer incidence patterns and differences among the Circumpolar Inuit of Canada, Alaska and Greenland.**

### Geographic area and physical environment

Canadian Inuit inhabit the Arctic regions of Canada located near or above the tree line in the Northwest Territories, Nunavik (Arctic Québec) and Labrador. Despite the vast distances and the very low population densities found, Inuit across Canada share a common culture, language and lifestyle, although some regional variations in dialects and lifestyles do exist. In all regions, traditional hunting and fishing territories for Inuit correspond closely with the seasonal migration routes of game both inland and in the coastal waters. Three vegetation zones are found: the taïga with its spruce forests in the southern limit; the wooded tundra at the northern portion of the taïga; and the tundra. The climate is subarctic or arctic and is influenced by both marine and continental factors. Each of the three main areas in Canada where Inuit reside is described below.

The Northwest Territories (NWT) covers 3.37 million $km^2$, encompasses four time zones, and comprises approximately one-third of the total land mass of Canada. It is bounded on the south by the 60th parallel of latitude, on the west by the Yukon Territory and the Beaufort Sea, on the east by Hudson's Bay, Davis Strait and Greenland, and extends in the north to the pole. In 1986, during the time cancer data were compiled for this study, the NWT population was dispersed throughout 60 communities in five regions: Baffin, Fort Smith, Inuvik, Keewatin and Kitikmeot. Temperatures vary widely from $-60°C$ in the winter to $+30°C$ in the summer.

Québec is the only Canadian province whose territory extends into the Arctic zone (1). Since 1988, the part of this territory inhabited by Inuit has been known officially as Nunavik, a place name that signifies a very large place where we live (2). Nunavik comprises 499 860 $km^2$, or one-third of Québec's total land mass, is bounded on the south by the 55th parallel of latitude, and extends along the shores of Hudson Bay to the west, Hudson Strait to the north, and Ungava Bay to the east.

The Labrador Ungava Peninsula is wedged between Hudson Bay, the St. Lawrence River and the Atlantic

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From the Health Statistics Division, Statistics Canada, Ottawa (L.A. Gaudette, R.-N. Gao), Department of Health and Social Services, Government of the Northwest Territories, Yellowknife, NWT (S. Freitag, M. Wideman), Centre de santé publique de Québec, Québec (R. Dufour) and Labrador Inuit Association, Newfoundland (M. Baikie), Canada.
Correspondence to: Leslie A. Gaudette, Health Statistics Division, Statistics Canada, 18D RH Coats Building, Tunney's Pasture, Ottawa, Ontario, Canada K1A 0T6.

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Ocean, with Labrador itself a part of the province of Newfoundland. Situated between 52 degrees and 60 degrees north latitude, it is bordered on the west and south by Québec and on the east by the Atlantic Ocean, covering an area of 290 079 km$^2$. The Atlantic coastline itself is 1 125 km long. The subarctic climate is considered harsh for the latitude; nearshore marine waters are ice-covered for 5–6 months of the year.

### Population and human environment

Ancestors of the Canadian Inuit are believed to have arrived with the final wave of migration from Siberia, crossing the Bering Strait from the Chukotka peninsula from 4 000 to 9 000 years ago (3–5) after the end of the ice age. Within the NWT, most of the Inuit population migrated to the Central and Eastern Arctic, while a small number stayed in the Inuvik coastal areas, and are now known as the Inuvialuit. Several distinct Inuit cultures emerged over time. The pre-Dorset culture used flint blades to cut bone and ivory for other tools and then used these to cut meat and skins; they later developed woodworking tools as climatic changes forced them to move south to the tree line. They were succeeded by the Dorset culture that originated about 2 700 years ago. The Dorset people are thought to have invented the snowhouse and oil-burning stone lamps, technologies that would have permitted a greater emphasis on sea-ice fishing (5). The Thule culture, which emerged about 1 000 years ago on the shores of the Bering Sea, was characterized by ocean-hunting, including whaling, as well as walrus and seal hunting using kayaks and umiaks, dogsledding, and permanent stone or dirt houses (5). The Thyle culture absorbed the Dorset culture and is the direct ancestor of the modern Inuit (4).

The term Inuit, meaning 'human beings', largely replaced the term Eskimo in the 1970s. From a nomadic existence at the end of World War II, the Inuit population has settled in fixed communities (6).

In Canada, 1981 Census data showed that 87% of Inuit lived in the northern areas of the NWT, Québec and Labrador, with 13% found in southern Canada. The 27 201 Inuit residing in northern regions, of which 64% lived in the NWT, 20% in northern Québec and 16% in Labrador, form the basis for all analysis and discussion in this report. Inuit males outnumber females; in 1986, the sex ratio (male:female) was greater than 1.0 up to age 24 years, after which no clear pattern emerges. In 1969–1973, the age-sex distribution for Canadian Inuit formed a wide-based population pyramid, with the largest proportions found in the 0–4 and 5–9 age groups. By 1984–1988, the base of the pyramid flattened for the younger age groups, with a relatively constant distribution for age groups up to 20 or 25 years. The 1984–1988 pattern for Canadian Inuit was intermediate between the wide-based pyramid found in Alaska and the inverted pyramid found for the youngest age groups in Greenland.

In 1986, Inuit (including the Inuvialuit) comprised 17 435 people, or one-third of the NWT population (52 240) and have since been the most rapidly increasing population group. Most Inuit reside in small coastal communities in the Inuvik, Baffin, Keewatin and Kitikmeot regions. In the late 1980s, Nunavik's population (7), of which 91% were Inuit, comprised 6 313 people living in 14 coastal villages, ranging in size from 100 to 1 100 persons. The median age was just 17.2 years. In 1986, the Labrador Inuit Association recorded 4 240 Inuit (or 16% of the total Labrador population of 26 740), of whom 59% were under 25 years of age. About 55% of Labrador Inuit live in one of five communities along the coastline; the remaining 45% live in Happy Valley/Goose Bay or Northwest River, both located on the shores of Lake Melville.

In 1991, life expectancy at birth for the NWT population was 70.3 years for men and 76.2 years for women, lower than the overall Canadian life expectancy of 74.6 years for men and 81.0 for women (8). Among NWT Inuit, current life expectancy would be lower still, although life expectancy for NWT Inuit has increased from 29 in the 1940s to 66 in 1978–1982 (9).

Birth rates for the NWT were about twice as high as those for Canada throughout the period 1969–1988, although this ratio has decreased in 1993 to 1.6. Overall, the total fertility rate for the NWT declined from 6.2 births per woman in 1966 to 2.7 in 1993. Comparable rates for Canada were 2.8 in 1966 and 1.7 in 1993 (10). Teenage pregnancy rates (including therapeutic abortions) for the NWT at 146.3 per 1 000 women in 1991 were the highest in Canada and more than three times the Canadian rate of 40.0 per 1 000 women. Birth rates for the three Inuit populations in NWT, Québec and Labrador were twice those for Canada in 1981, and had declined about 50% from the peak fertility reached in 1961. Birth rates and trends were comparable for all three Inuit populations from the 1930s onward (9).

In Nunavik (northern Québec), Inuit life expectancy has improved considerably, from 35 years (9) in the 1940s to about 65 years in the late 1980s (compared to 75 years in Québec). Rates of infant morbidity and mortality, although improving, are still much higher than those in Québec and Canada. Similarly in Labrador, infant mortality rates for 1974–1985 were higher than in the rest of Canada.

Canadian Inuit populations lived largely in isolation from the rest of Canada and continued to follow traditional lifestyles until somewhat later than their counterparts in Alaska and Greenland. World War II was a major turning point, with the establishment of military bases throughout the North, including the air base at Goose Bay, Labrador. By the 1950s, the Federal Government had taken a greater interest in the socio-economic status of the

Inuit population, who were then provided all benefits, including social assistance, available to southern Canadians. Considerable disruption at this time resulted from evacuation of Inuit for one to two years to southern sanatoria to treat the tuberculosis that existed at very high levels in the population, and of children to residential schools. More recently, communications have been dramatically altered in the North. For example, in Nunavik, a satellite telephone system was introduced in the late 1970s, national television in the early 1980s, and improved air transportation provided with daily connections to Québec City or Montreal.

Most Inuit communities in Canada are too isolated to allow reasonable access to major labour markets, and thus have a limited economic base of their own. Jobs are scarce and income is derived from a variety of sources, primarily a combination of hunting, trapping, part-time employment and social assistance. A labour force survey conducted in the NWT in the winter of 1989 found that just 31% of Inuit and 27% of Inuvialuit were employed, compared with an overall employment rate for the NWT of 84% (11). However, significant seasonal variations do occur in employment. In Labrador, with the exception of some industrial developments that provide wage employment in the central and western regions, the economy is sluggish with high unemployment and poverty. The economy of coastal Labrador is based on the seasonal fishery, and most full-time employment is with government funded service agencies. In contrast, as a result of the James Bay Agreement for northern Québec, disposable income in Nunavik is now almost equivalent to the Québec average.

## Lifestyle and diet

Traditionally, Inuit life was devoted to hunting, fishing, and gathering. In winter, the Inuit lived along the coast in snow houses and hunted sea mammals. During the summer, the population moved inland to hunt land animals and fish, and to collect berries, herbs and other vegetation (12, 13). Inuit today still exploit animal resources for their food. Depending on the species, raw, frozen, dried, or fermented game, fish, and sea mammals represent an important part of the diet in nutritional, socioeconomic and cultural terms. The unique traditional Inuit diet is capable of providing all essential nutrients (12, 13). However, since the 1950s, store-bought foods of lower nutritional quality have become more available. The ensuing declines in nutritional status among Inuit are associated with the emergence of patterns of ill-health associated with southern lifestyles (13, 14).

Compared with their ancestors, present day Inuit consume more carbohydrates, particularly simple carbohydrates, and less overall fat, but more saturated and less poly-unsaturated fats and omega fatty acids (14). Consumption of salt and sugar, not found in the traditional Inuit diet, has increased substantially (13). Overall, Inuit diets are low in calcium, folacin and vitamin A, particularly for women of child-bearing age (14, 15). Dietary food sources are also influenced by the presence of industrially-derived contaminants (14). Pollution of the land and sea environments, mostly due to long-range transport via the atmosphere or ocean currents, has resulted in contamination of the food chain by organochlorides and heavy metals. This has led to concern about possible health effects due to chronic dietary exposure of the general population and exposure of infants prenatally and through breast milk. In fact, the PCB levels in the breast milk of Inuit women in Nunavik are among the highest ever reported (16, 17). However, while organochlorides are found at somewhat higher levels among Inuit than in southern populations (14, 18), a recent survey concluded that these levels, while warranting close observation, did not require immediate intervention, given that the traditional diet affords considerable protection against other diseases (18).

Inuit health problems represent a mixture of those found in developing as well as developed countries (3, 19). Infectious diseases are declining, yet still remain important health problems. At the same time chronic conditions are emerging, although still generally occurring at a lower rate than in the south. In addition, wide-spread social problems occur, including: substance abuse (drugs, solvent inhalation and alcohol); family violence, including sexual abuse of women and children; and accidental and violent deaths, including high rates of suicide among adolescents and young adults, and fires. Water and sewer systems in Inuit communities as well as housing are often inadequate. These social conditions reflect a society whose traditional values are being eroded (3).

Respiratory problems account for 15% of deaths in Nunavik and are the major reasons for consultations in the nursing stations and the principal cause of hospitalizations (five times as high as in Québec). Tuberculosis remains a problem, although rates among Canadian Inuit have declined since the 1950s at a faster rate than that recorded in any other population around the world, and are now lower than those recorded in other North American Indian populations (3, 20). Unusual infectious diseases, such as trichinosis and botulism are also seen (3). Chronic otitis media (21, 22) among children and sexually transmitted diseases (23) are important health problems (24). Hepatitis B prevalence is high among Inuit, with reported rates being highest in Greenlandic Inuit, and lowest in Canadian Inuit (3). Sexually transmitted diseases, including syphilis, gonorrhoea, chlamydia, yeast infections, herpes simplex and human papilloma virus generally show evidence of higher rates of infection among Canadian Inuit (3, 13, 25) than southern Canadians.

Chronic conditions such as cancer, cardiovascular disease and diabetes, together with obesity and high blood

pressure, represent a group of diseases that share similar risk factors and can serve as indicators of the impact of 'western' lifestyles. Rates of ischemic heart disease, although increasing, remain low among Inuit, despite the presence of smoking, stress and obesity as risk factors (3, 26) in part because of the protective effect of the Inuit diet. Diabetes and hypertension, while increasing in rate, still occur in Inuit at levels below those among the general Canadian population (3, 13, 27) and generally do not show the increased rates found among other Aboriginal groups. Obesity has generally been less prevalent among the Inuit (3), although a recent survey has found levels comparable to the Québec population as a whole (27).

Inuit women, men and children are heavy cigarette smokers (28), and at least in the NWT, the use of chewing tobacco and snuff is relatively common. The NWT has the highest percentage of smokers in Canada, and within the NWT, rates are highest for the Inuit population. In 1985, of Inuit aged 20 and over, 77% of women and 66% of men were current smokers, compared with Canadian rates (in 1986) of 27% for women and 32% for men (29). Smoking rates among school children in the NWT were the highest ever reported for any school population in Canada; a 1987 survey reported that 57% of Inuit students aged 15–19, 34% of those aged 10–15, and 11% of 5–9 year olds were current smokers (30). In addition, close to 20% of Inuit males aged 10–19 reported current use of chewing tobacco and snuff, compared with less than 1% among non-Native school children (30).

Alcohol consumption in the NWT is the second highest of the Canadian provinces and territories. In 1988–1989, NWT residents consumed 10.9 litres of absolute alcohol per capita compared with the Canadian average of 8.9 (31).

### Health services and cultural accessibility

In the decades around the turn of the last century, redimentary western health care provided by the churches and missionaries began to supplement traditional health care. The first recorded health facility in the NWT was a hut for the sick situated at Black Head Island in Cumberland Sound in the Eastern Arctic in the late 1800s, while the first hospital established in the Eastern Arctic was St. Luke's, built by the Anglicans in 1930 in Pangnirtung.

The federal government provided medical services in the NWT through offices based in Winnipeg, Edmonton, and Ottawa until 1967, when the Northern Region Medical Services Branch was created with headquarters in Edmonton. In 1980, the NWT Regional headquarters were moved from Edmonton to Yellowknife, and in 1988, responsibility for health care delivery was transferred to the Northwest Territories Department of Health (32).

Today, health care is provided free to all residents of the NWT. Hospitals are located in the larger centres of Yellowknife, Hay River, Inuvik, Iqaluit, Fort Smith, and Fort Simpson, whereas 42 health centres and five satellite clinics serve the remainder of the NWT. In all, 45 physicians and over 300 nurses deliver health care in the NWT, with additional physicians providing services under contract (e.g., through university-based centres). However, most tertiary care is still delivered by larger facilities located in Edmonton, Winnipeg, and Montreal, particularly for specialized diagnostic and treatment services (e.g., for cancer) not available in the North.

In Nunavik, the regional government is now responsible for deciding how best to promote health, and for operating a Regional Board for Health and Social Services. Two 25-bed sub-regional hospitals, one in Kuujjuaq on Ungava Bay, and one in Povungnituk on Hudson Bay, each serve seven villages and provide services in general medicine, minor surgery, paediatrics, outpatient and emergency care, with a number of beds allocated to chronic care. A birthing centre, staffed with Inuit midwives, is attached to the Povungnituk hospital (33, 34). Nursing stations provide health care in the other 12 villages. All medical services are free of charge, including dental care and medication. Most medical and nursing services are provided by non-Aboriginal personnel, due to a lack of qualified Aboriginals. About 100 nurses are the focal point for activities related to curative care and health promotion, while five doctors are based in each hospital. Specialized care is given in southern hospitals in Montreal and Québec City, with an air-ambulance available when circumstances prevent the use of commercial flights.

In Labrador, Sir Wilfred Grenfell developed a health care delivery system in the late 1880s. This evolved into Grenfell Regional Health Services, a government-funded agency that currently operates nursing stations and hospitals in the area. Inuit requiring care not available in their home community are sent first to hospitals in Labrador (Goose Bay) or northern Newfoundland (St. Anthony). For specialized services including cancer treatment, patients are referred to St. John's, Newfoundland.

Increasing attention is being paid across northern Canada to cultural aspects of health and health care. In this context, the health and disease status of the Inuit must be considered not only in its biological, but also its cultural and social contexts (3). Research carried out on the Inuit understanding of the body (35, 36) and on Inuit categories of health and sickness demonstrates that a holistic approach exists in traditional Inuit medicine. Effective health promotion and prevention of all health problems, from cancer to otitis media, cannot occur without the integration of this traditional knowledge into the health care system.

In the context of Inuit health, where a cultural gap exists between health-care providers (often non-Aboriginal) and their beneficiaries, a culturally adapted approach is critically important. One way of working towards such an

integration is the training of the Inuit as health care professionals who can work within their own language and culture. The training of Inuit midwives in Povungnituk is proving to be a successful example of this approach.

### Sources of cancer data

*National Cancer Incidence Reporting System (NCIRS).* Data used in this study comprised new cases of cancer among Inuit as reported to the NCIRS at Statistics Canada in Ottawa (37, 38) from cancer registries located in the NWT (39–42), Nunavik (43), and Newfoundland (for Labrador patients of Inuit origin). New primary sites of cancer were reported from 1969 onwards using case definitions for the NCIRS and edited for validity of information in each field and compatibility of different elements within a record. Between 1969 and 1978, cases were generally coded according to the ICDA-8 classification. From 1979 to 1988, the ICDO-1 classification was used for tumour topography and morphology, with some morphology available for prior years. All data were converted into ICD9 codes and any conflicts returned to the reporting registry for resolution. From 1969 to 1988, 661 invasive cancers were identified among Canadian Inuit (excluding in situ and non-melanoma skin cancers). Of these, 402 cases (60.8%) were from the NWT, 156 (23.6%) from Nunavik, and 103 (15.6%) from Labrador.

*Northwest Territories.* From 1969 to 1984, cancers were registered by the Edmonton office of the Medical Services Branch, based on reports of new cases of cancer and cancer deaths received from nursing stations; these cases were reported annually to the NCIRS. When responsibility for health care was transferred to the territorial government, the NWT Department of Health, in cooperation with the NWT Medical Association, developed legislation that required mandatory reporting of cancer cases as of 1990.

In 1986, the NWT cancer registry was established in Yellowknife at the NWT Department of Health (39, 40), by compiling data reported from at least 1969 onwards from these sources: death registrations with any mention of cancer obtained from the NWT Vital Statistics office; listings of Inuit patients provided by Dr. Otto Schaefer (44, 45); case listings supplied by the Alberta, Manitoba and Québec cancer registries; and case listings received from the NCIRS. The lists were cross-checked to remove duplicates. When an initial review of data from 1970 to 1984 indicated under-registration of cases in the Baffin Region in the mid-1970s (42, 46, 47), additional cancer cases from this region were abstracted by one author (S.F.) based on medical records located in Baffin House in Montreal, Québec.

Inuit status in the NWT was verified based on information received from a variety of sources including death registrations, a population register maintained by NWT Vital Statistics, the NWT Health Care Plan, patient listings supplied by Dr. Otto Schaefer (44, 45), and the presence of an Eskimo disc number on some NCIRS records for earlier years.

*Québec (Nunavik).* Cases for Québec Inuit were identified by reviewing medical records located at the hospitals in Kuujjuaq and Povungnituk, or at centres providing patient services to Inuit in Québec City and Montreal, or from medical records maintained by Health and Welfare Canada. Death registrations for Northern Québec, obtained from Vital Statistics mortality records kept at Statistics Canada, were reviewed and those likely pertaining to Inuit were returned to the Vital Statistics office in Québec City and cross-checked by one author (R.D.) against the Québec Inuit cancer registry. The resulting Inuit registry was also cross-checked against a listing of all incident cancers reported to the NCIRS for northern Québec to identify any missed cases. Inuit status was also verified in consultation with community health workers. All data were coded in ICDO-1, and edited and corrected using NCIRS computer software, prior to being included in the Inuit registry developed for this study.

*Labrador.* Listings of cancer cases for Labrador residents, obtained from the NCIRS at Statistics Canada, were reviewed and updated with missed cases by cancer registry staff at the Newfoundland Cancer Treatment and Research Foundation. Two methods were used to identify Inuit status, which for the purposes of this study included anyone of Inuit ancestry. For the earlier time period, a list of all cancer cases for Labrador was reviewed by community nurses familiar with the ancestry of their patients. Death registrations for Labrador for the period 1969–1988 were also reviewed for any evidence of Inuit status. For later years, this assessment was supplemented by cross-checking the lists of cancer cases with the membership list of the Labrador Inuit Association (LIA), which includes persons of Inuit ancestry who are thereby eligible to receive health and education benefits.

### Sources of population data

*Canada.* Data for Inuit populations were assembled for 1971, 1976, 1981 and 1986 by 5-year age group and sex for each region. Inuit residing in southern Canada were excluded from all population counts, consistent with the methods used to identify cases. In all areas for 1976, population data by 5-year age group, sex and region were obtained by linear interpolation between 1971 and 1981.

*Northwest Territories.* Published data from the 1971 and 1981 Censuses were obtained, whereas for 1986 a special tabulation of Census data for 'Inuit origin, single response' was used, as these most closely corresponded to data used for previous years. Further, the proportion of multiple responses in 1986 was low for NWT Inuit. Since the special tabulation did not break down the 65 and over age

group, data by 5-year age groups from 65 and over were estimated using a life table method.

*Nunavik*. Data were obtained from the northern Québec population register for 1971, 1981 and 1986, with register totals varying by about 5–10% from census populations (9).

*Labrador*. Census data for Inuit for 1971 and 1981 underestimated the Inuit population by abour 50%, thereby significantly inflating the Standardized Incidence Ratios (42, 47). The underestimation occurred because, while the vast majority of Inuit in the NWT or northern Québec reported single ethnic origins, Labrador Inuit in 1986 reported multiple origins almost as often as single. Data prior to 1986 were collected only for single responses. Population data were revised as follows. First, the 1986 Census Inuit population of 4 120 (including both single and multiple origins) was found to agree well with the adjusted July 1, 1986 count of 4 240 determined from the LIA membership lists, after the LIA list first computerized in 1989, had been updated with known deaths occurring from 1986 onwards.

Since Census population counts for multiple origins were not available for 1971 or 1981, the Labrador Inuit populations were estimated by applying the proportions of Inuit living in each community from the 1986 Census to the total Census population living in each community in 1971 and 1981. After making adjustments to account for growth patterns in each community, estimates of the Inuit population in each community were summed to derive a total, to which the age–sex distribution of the original census data for each year was applied.

*Detailed tabular material by 5-year calendar periods 1969–1988 is available upon request. Please contact the Danish Cancer Registry, Danish Cancer Society, Strandboulevarden 49, DK-2100 Copenhagen, Denmark.*

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