Nunavut Department of Health and Social Services

1992 - 2001

A TEN-YEAR PROFILE OF CANCER IN NUNAVUT

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Cover image: Joan Fraser

FOREWORD

Cancer comprises a family of diseases, which challenges individuals, families and communities worldwide. It is a complex disease that defies our attempts at control. Nevertheless, some progress has been made in the area of prevention. In general, it has been estimated that approximately one-third of cancer cases are related to smoking, one-third to poor diet and lack of exercise, and one third to genetic or other factors. Tobacco control policies in Canada are having an impact, while dietary modification is having an impact on national colorectal cancer incidence. Regrettably, in Nunavut, lung cancer accounts for 40% of our invasive cancers and colorectal cancer accounts for 16%. The trend in both appears to be rising. With effective preventive strategies there is huge potential to drastically reduce these rates (bearing in mind that it will take many years to see the effects of these strategies). Tobacco control has to be our highest priority.

Apart from prevention, the other components of cancer control include early detection and screening, treatment, rehabilitation and palliative care. Screening to detect early or pre-cancerous lesions is always controversial and must fulfill certain criteria to be effective. Cervical cancer screening fulfills these criteria but the uptake in eligible women in Nunavut is only 40%. Breast cancer screening is more complex, costly, and of questionable benefit to women in Nunavut given the low incidence and mortality rate here. Rates may increase as a more "western lifestyle" is adopted so continuing evaluation and monitoring of breast cancer in Nunavut using the Cancer Registry will be important. Screening for colorectal cancer also requires further monitoring.

Good information facilitates the development of effective policies and programs.

This report deals only with cancer incidence. Survival and mortality data are not yet available, therefore, we are unable to comment on treatment and outcome. Another limitation is that due to the small population size, we are dealing with very small numbers of cases. This makes interpretation of the data difficult. But despite these limitations the Nunavut Cancer Registry and this report are an extremely valuable tool for planning, monitoring and evaluating cancer control strategies. Good information facilitates the development of effective policies and programs. Priority for the future will have to be placed on prevention and thus knowledge about the trends in incidence associated with cancer in Nunavut is essential.

Dr. Geraldine Osborne
Chief Medical Officer of Health.

July 31st 2003

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INTRODUCTION

Nunavut, Canada's newest territory, came into being on April 1, 1999. It covers around 1.9 million square kilometers – about one-fifth of Canada's total landmass. The population of Nunavut is approximately 27,000, which represents 0.1% of Canada's total population. The people are scattered across the territory in 26 geographically isolated communities. The sizes of the communities range from 5200 for the capital city, Iqaluit, to 500 for the smallest community.

The population profile of Nunavut is unique. Eighty-five percent of its residents are Inuit. The age structure of the general population also stands in marked contrast to that of the rest of Canada in that it has a particularly high number of children and youth and a particularly low proportion of the elderly.

Cancer is a growing concern in Nunavut and because most of the communities are small, almost everyone has been touched either directly or indirectly by this disease. Treatment, and often diagnosis of cancer, is generally not undertaken in the territory itself. Most cancer patients are treated in one of 4 out-of-territory cities: Yellowknife, Ottawa, Winnipeg and Edmonton. This can present challenges because of the distance between local health care providers and emotional support networks.

The study of the pattern of cancer incidence in the territory is essential to the public health decision making process. This report represents the first such analysis conducted in Nunavut. It provides baseline data on the picture of cancer incidence in the territory, and highlights significant patterns. This information will assist policy makers and health care providers to better understand the factors that contribute to cancer incidence in the territory and the efficacy and importance of screening programs. Ultimately, accurate, timely data will assist public health officials to make the most cost effective and informed decisions about programming in the territory.

This report represents the first such analysis conducted in Nunavut. It provides baseline data on the picture of cancer incidence in the territory, and highlights significant patterns.

HIGHLIGHTS

- Approximately 50 new cases of cancer are diagnosed in Nunavut each year.
- Cancer of the lung, colon, breast and nasopharynx were the most common invasive cancers diagnosed in Nunavut between 1992 and 2001.
- Cancer of the salivary gland, nasopharynx, esophagus, colon, liver and the lung occur at higher rates in Nunavut than in the rest of the country.
- Nunavut's rates are lower than the national rates for cancer of the breast, prostate, bladder, kidney and uterus as well as leukemia, non-Hodgkin's lymphoma and melanoma.
- Lung cancer is the most common cancer in Nunavut, accounting for 39% of the invasive cancer cases in the 10-year period.
- Colorectal cancer is the second most common invasive cancer in Nunavut.
- In Nunavut, approximately 70% of colon cancers occur before the age of 70 while in Canada, approximately 70% of colorectal cancers occur after the age of 70.
- Breast cancer rates are 3 times lower in Nunavut than they are in the rest of Canada.
- Prostate cancer rates are 10 times lower in Nunavut than they are in the rest of Canada.
- The most common cancer occurring in men was cancer of the lung, which accounted for 43% of all cancers in men.
- The most common cancer in women was cancer of the cervix, which accounted for 30% of all (malignant and in situ) cancers diagnosed in women.
- Approximately 75% of cervical cancer cases in Nunavut were diagnosed between the ages of 20 and 39.

DATA SOURCES AND PROCESSING

The information source for this report on cancer in Nunavut is the Nunavut Cancer Registry (NCR). The Nunavut Disease Registries Act requires that all cases of cancer diagnosed on a Nunavut resident be reported to the Nunavut Cancer Registry. The NCR is now maintained as part of the Information and Research Section of the Nunavut Department of Health and Social Services. Information in the registry is obtained from the following sources:

- Pathology reports from Baffin Regional Hospital and out-of-province hospitals.
- Registry report forms from health care professionals.
- Death certificates from Statistics Canada's Health Statistics Division's Vital Statistics Database.
- Reciprocal notifications from other Canadian cancer registries.

Information on the patient and the nature, topography (site) and morphology (cell type), of the cancer are collected. The information was then coded in a standard format according to the International Classification of Diseases for Oncology, Second Edition (ICD-O-2) until 2000, and in the Third Edition (ICD-O-3) starting in 2001. The data is then submitted to the Canadian Cancer Registry (CCR) where the records are checked for quality and accuracy through a number of detailed edit processes.

The NCR operates in accordance with standards set out by the CCR, and the North American Association of Central Cancer Registries (NACCR).

Data Processing

Cancer incidence records were extracted from the NCR database. It does not include benign tumor incidence. A reasonably complete dataset was available from 1992 to 2001. All records from before and after that timeframe were excluded. In addition, a person may be diagnosed with more than one primary, invasive cancer in their lifetime, and all occurrences of non-metastatic primaries are recorded under the standards of the CCR. For the purposes of this report, however, the second occurrence of a malignant primary was excluded from the dataset. This was generally due to difficulties in obtaining enough information to adequately determine if the second primary was or was not in fact a metastasis. Failing this, Nunavut's rates would be artificially inflated compared to those of the rest of the country where medical records are much more accessible.

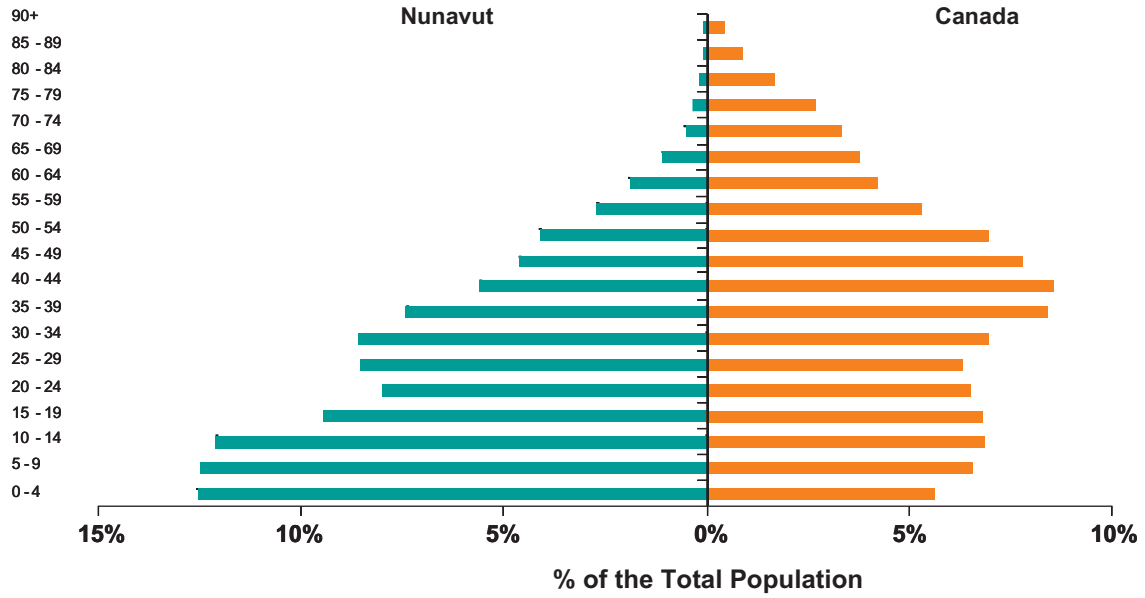
The Nunavut Disease Registries Act requires that all cases of cancer diagnosed on a Nunavut resident be reported to the Nunavut Cancer Registry.

As is the case with the national and most other provincial registries, data on basal and squamous cell skin cancers are not collected.

Site groupings were based on those used by Health Canada, see Appendix A.

Population estimates were provided by the Nunavut Bureau of Statistics. For a detailed overview, see Appendix B.

Age-standardization was done using the 1991 Canadian Standard Population, see Appendix C, to allow for meaningful comparisons of cancer rates over time and between the Territory and the country as a whole. This is a procedure where weighted averages of age-specific rates are used to modify rates to a standard population in order to minimize the effects of differences in the age composition of given populations when comparing rates for these populations.



Source: Nunavummit Kiglisiniartiit, from 2001 Census data

Fig. 2.1 Age Pyramid: Nunavut vs. Canada, 2001

Nunavut has the inverse population profile of the Canadian Standard Population. Whereas the Canadian population is older, Nunavut's population is younger and this poses significant challenges with selecting an appropriate 'standard population' for making comparisons with Canada.

Analyses were generally based upon incidence combined over a ten-year time period to reduce problems associated with the computation of small numbers.

Confidence intervals were used in order to evaluate comparisons. Statistical significance was assessed to determine if comparisons between rates were different or not.

Nunavut has the inverse population profile of the Canadian Standard Population. Whereas the Canadian population is older, Nunavut's population is younger and this poses significant challenges with selecting an appropriate 'standard population' for making comparisons with Canada.

Confidentiality

Data confidentiality is ensured by strict guidelines for data access which are outlined in Section 12 of the Disease Registries Act.

In order to avoid disclosure of any patient's identity, age-specific and site-specific incidence counts are not provided when the total is below 5 cases.

Data Quality

To minimize bias due to under reporting, ascertainment of cases is crosschecked with medical travel data (since cancer has to be treated out of territory), with southern medical liaison personnel, community health information and the vital statistics database.

CANCER PROFILE IN NUNAVUT

Table 3.1 Incidence and Age-Adjusted Rates of Invasive Cancer in Nunavut and Canada

Site Grouping	10 yr Incidence	Rate Nunavut*	Rate Canada[1]	Comparative Incidence Figure
All Sites	**358**	**405.6(356.9-461.0)**	**391.1**	**1.0**
Salivary Gland	6	3.3(1.1-14.7)	1.0	3.3
Nasopharynx	20	14.6(8.3-28.4)	0.6	24.3***
Esophagus	6	7.2(2.1-21.2)	3.9	1.8
Stomach	9	11.1(4.0-26.9)	9.8	1.1
Colon and Rectum	57	69.7(49.6-97.1)	50.3	1.4
Liver and Intrahepatic Bile Duct	11	16.5(6.9-35.0)	3.4	4.9***
Lung and Bronchus	142	193.9(159.7-235.0)	62.1	3.1***
Breast**	20	35.2(18.6-69.1)	98.5	0.4***
Cervix Uteri**	5	7.9(2.1-34.3)	9.2	0.9
Prostate**	7	10.9(3.2-34.9)	109.6	0.1***
Urinary Bladder	5	8.9(2.5-24.6)	15.4	0.6
Kidney and Renal Pelvis	9	8.5(3.7-21.5)	11.3	0.8
Brain and Other Nervous System	9	2.9(1.2-14.0)	7.1	0.4
Thyroid	5	2.5(0.8-13.8)	5.3	0.5
Non-Hodgkin Lymphoma	7	5.4(1.9-17.7)	16.2	0.3
Leukemia	5	7.9(1.8-24.0)	11.1	0.7
All Other Sites	35	-	-	-

See notes 1, 2, 3 and 7
* 95% Confidence Interval
** Does not include in situ cancer
*** Significant Difference

The above rates do not take in situ cancer incidence into account because these are not included in the national rates. Type-specific in situ cancer incidence is discussed in each respective section.

A total of 358 Nunavummiut were diagnosed with malignant cancer in the ten-year period between 1992 and 2001. The overall rate of cancer incidence in Nunavut is not significantly different than the rate in the rest of Canada.

In Nunavut certain cancers occur in higher proportions than in the rest of the country, this includes cancers of the nasopharynx, colorectum and the lung.

The highest rates of cancer incidence in Nunavut occurred in the following sites: lung, colorectum, female breast, and nasopharynx.

In Nunavut certain cancers occur in higher proportions than in the rest of the country, this includes cancers of the nasopharynx, colorectum, and the lung. One of these, cancer of the nasopharynx, is comparatively rare in the rest of the country[1].

The rate of many of Nunavut's cancers are lower than those in the rest of Canada, including cancer of the female breast, prostate cancer, non-Hodgkin's lymphoma, cancer of the bladder, kidney cancer and leukemia. The incidence for melanoma, and cancer of the body of the uterus were so low in Nunavut that rates could not be calculated, even though these cancers are among the ten most common cancers nationally[1].

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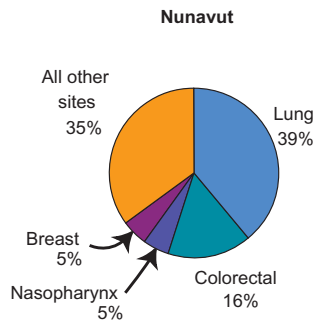


Fig. 3.2 Percent Distribution of Invasive Cancer, Nunavut

See note 1

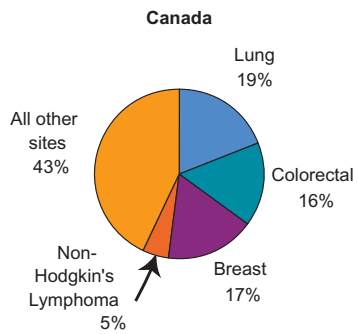
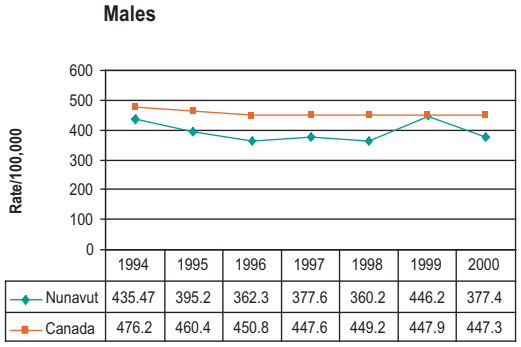


Fig. 3.3 Percent Distribution of Invasive Cancer, Canada[1]

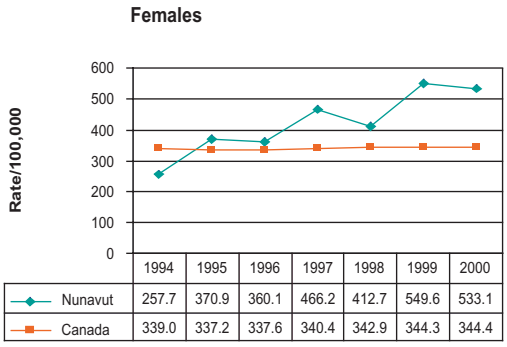
See note 3

In Nunavut, nearly 40% of all invasive cancers were of the lung whereas in Canada lung cancer accounted for only 19% of total cancer incidence. On the other hand, breast cancer accounted for a much smaller proportion of Nunavut's cancer cases than those of Canada. Non-Hodgkin's Lymphoma, which represents approximately 5% of Canada's cancer cases is fairly rare in Nunavut.



	1994	1995	1996	1997	1998	1999	2000
Nunavut	435.47	395.2	362.3	377.6	360.2	446.2	377.4
Canada	476.2	460.4	450.8	447.6	449.2	447.9	447.3

Fig. 3.4 Rates of Invasive Cancer, Nunavut vs. Canada, Males



	1994	1995	1996	1997	1998	1999	2000
Nunavut	257.7	370.9	360.1	466.2	412.7	549.6	533.1
Canada	339.0	337.2	337.6	340.4	342.9	344.3	344.4

Fig. 3.5 Rates of Invasive Cancer, Nunavut vs. Canada, Females

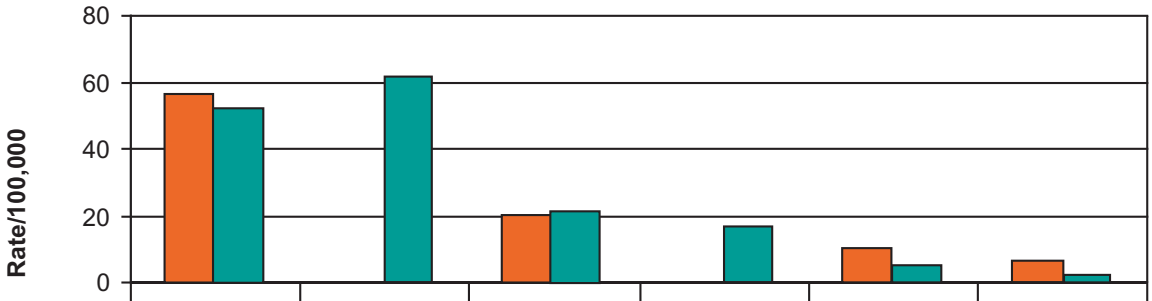
Three-year rolling averages used. See note 4.
See notes 1, 2, and 5

The incidence rate for invasive cancer in Nunavut's women is higher than that of the rest of the country[1] and appears to be increasing. However, this does not appear to be due to any one cancer in particular. Note that these data do not include cancer in situ.

The incidence of cancer in men in Nunavut is lower than that of men in the rest of the country[1], this is possibly due to high rates of prostate cancer nationally.

MAJOR CANCER SITES

Gender



	Lung	Cervix	Colorectal	Breast	Nasopharynx	Liver
Male	57.34	0	20.58	0	9.56	5.88
Female	52.73	61.79	21.32	16.48	5.77	2.47

Fig. 4.1 Incidence Rates for Major Cancer Sites by Gender

Rates adjusted for the 1996 gender distribution of Nunavut's population.
See note 1.

Nationally, the rates of cancer are higher in men than in women. This difference is not as obvious in Nunavut where there is relatively little difference in cancer incidence by gender.

Table 4.2 Top 5 Crude Rates of 5 Most Common Cancer Sites, Malignant and In Situ, Males

Males	Incidence	Rate/100,000
Lung	78	66.16
Colorectal	28	23.75
Nasopharynx	13	11.03
Liver	8	6.79
Prostate	7	5.94

Rates based on sex distribution of Nunavut's 1996 population
See note 1.

Table 4.3 Top 5 Crude Rates of 5 Most Common Cancer Sites, Malignant and In Situ, Females

Females	Incidence	Rate/100,000
Cervix Uteri	75	58.25
Lung	64	49.71
Colon	29	22.52
Breast	23	17.86
Nasopharynx	7	5.44

Age

Age is perhaps the single most important determinant of cancer occurrence with more cases generally occurring in older people.

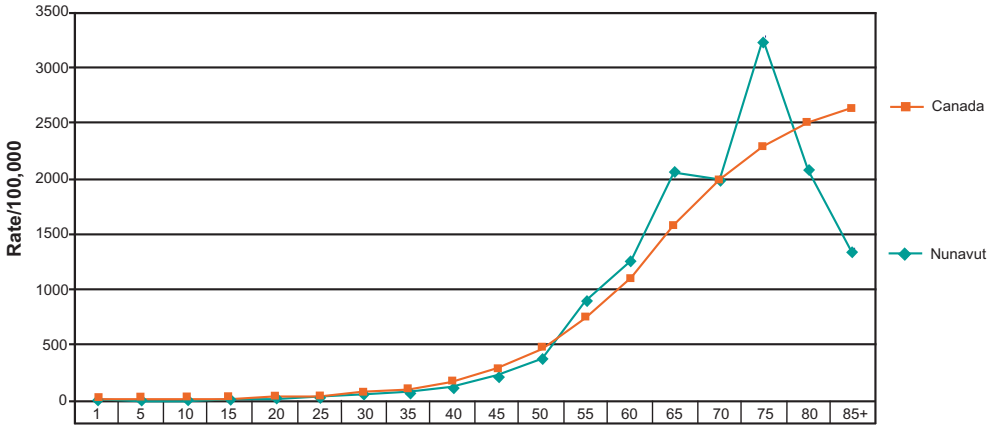


Fig. 4.4 Age Adjusted Rates of All Invasive Cancer, Nunavut vs. Canada

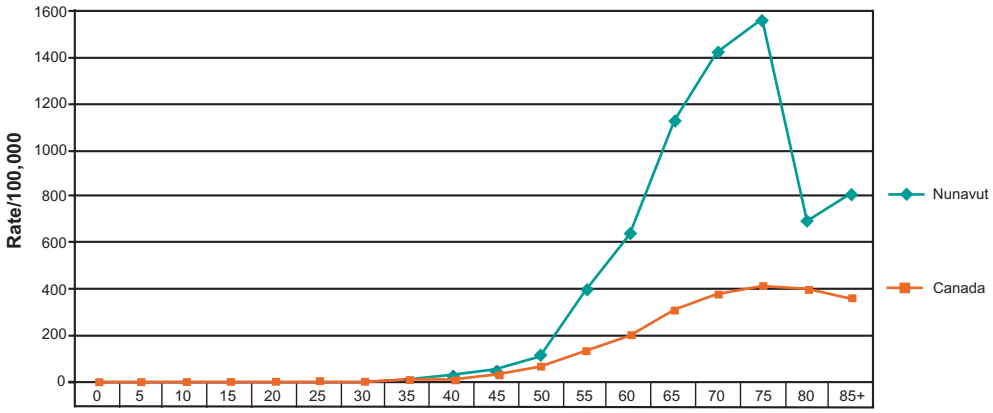


Fig. 4.5 Age Adjusted Rates of Lung Cancer, Nunavut vs. Canada

Drop in rate due to small population 70+, See Appendix B
See notes 1, 2 and 3

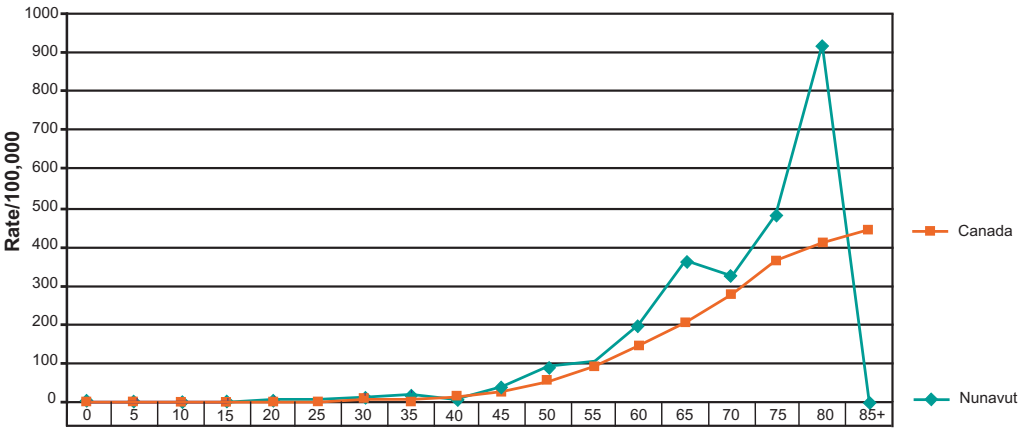


Fig. 4.6 Age Adjusted Rates Colorectal Cancer, Nunavut vs. Canada

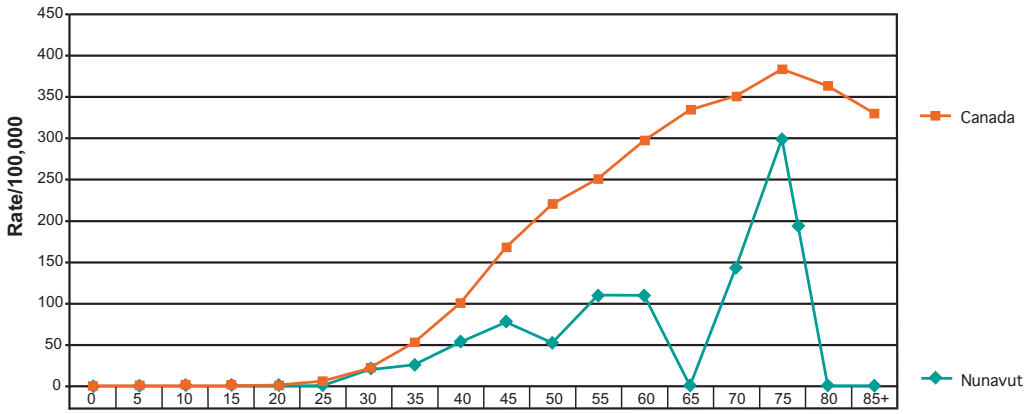


Fig. 4.7 Age-Adjusted Rates of Invasive Breast Cancer, Nunavut vs. Canada

Drop in rate due to small population 70+, (See Appendix B)
See notes 1, 2 and 3

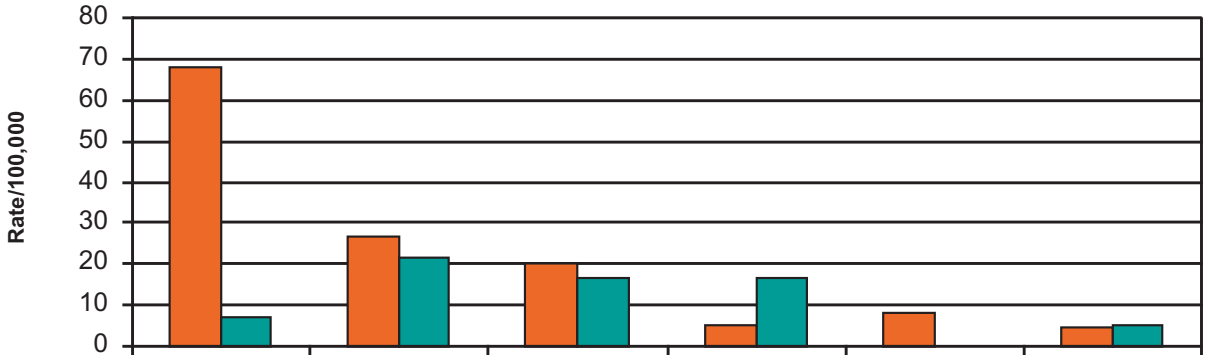
The graphs above show "age-adjusted" rates. This is a process that reflects a theoretical situation of what the rates would be if both populations had an age distribution like, in this case, the 1991 Canadian Standard Population.

Unlike Canada, Nunavut's age-adjusted rates do not produce a smooth line. This can be attributed to the relatively small population of Nunavut, see Appendix B.

The population of Nunavut drops dramatically after age 69.

Of the six major cancers seen in Nunavut, the age-adjusted rates are higher than Canada with the exception of breast cancer.

Ethnicity



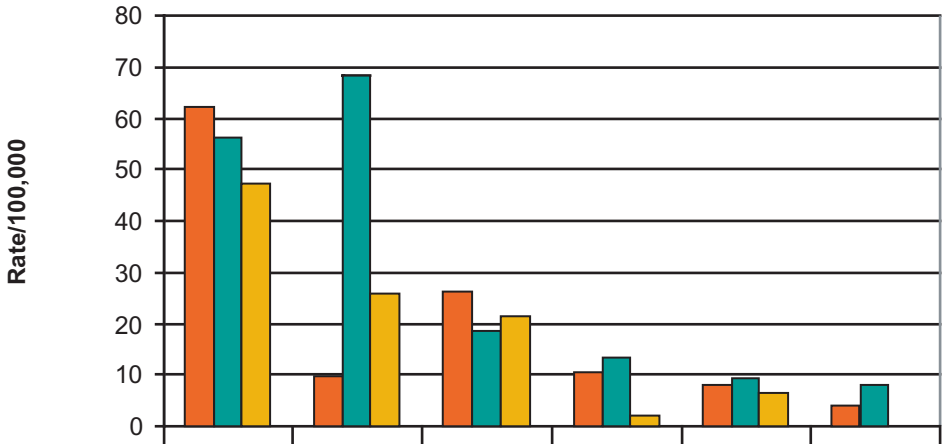
	Lung	Cervix	Colorectal	Breast	Nasopharynx	Liver
Inuit	67.84	26.76	20.27	5.27	8.11	4.46
Non-Inuit	7.19	21.56	16.77	16.77	0	4.79

Fig. 4.8 Incidence Rates for Major Cancer Sites by Ethnicity

Rates adjusted to the 1996 ethnic distribution of Nunavut's population. See note 1.

The only statistically significant difference in cancer occurrence between Inuit and non-Inuit in Nunavut is with lung cancer. The incidence of lung cancer is significantly higher in Inuit than in non-Inuit. It should be noted, however that there is a significant out migration of non-Inuit after age 55[2].

Region



	Lung	Cervix	Colorectal	Breast	Nasopharynx	Liver
Baffin	62.15	9.56	26.29	10.36	7.97	3.98
Kivalliq	56.15	68.18	18.72	13.37	9.36	8.02
Kitikmeot	47.46	25.89	21.57	2.16	6.47	0

Fig. 4.9 Incidence Rates for Major Cancer Sites by Region

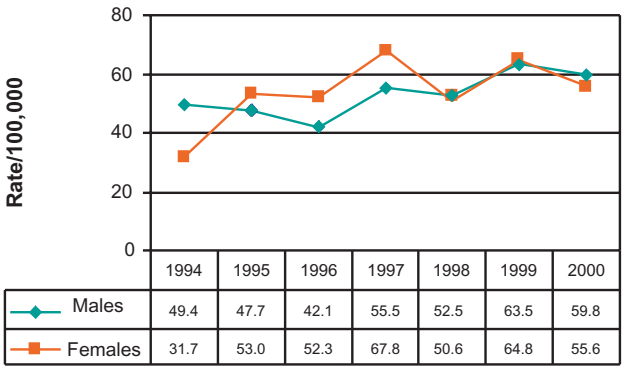
Rates adjusted to the 1996 regional distribution of Nunavut's population.
See note 1.

It is possible that the large geographic differences may present differences in relevant exposures by region. The table above shows the incidence of the most common cancer types in Nunavut by region. The only statistically significant difference is seen with cervical cancer rates, which are strikingly higher in the Kivalliq region. An analysis of this peak by year does show there is a decreasing trend from 1992 to 2001.

LUNG CANCER IN NUNAVUT

There were a total of 142 cases of lung cancer reported for the period between 1992 and 2001, comprising 40% of all cancers reported in Nunavut in the 10 year time period. Age-standardized incidence rates were 202.2 for men and 181.7 for women, both significantly different than the national rates which were 82.77 and 41.93, respectively[1]. The high rates are similar to those observed in other circumpolar Inuit in Alaska and Greenland[3].

Trend



	1994	1995	1996	1997	1998	1999	2000
Males	49.4	47.7	42.1	55.5	52.5	63.5	59.8
Females	31.7	53.0	52.3	67.8	50.6	64.8	55.6

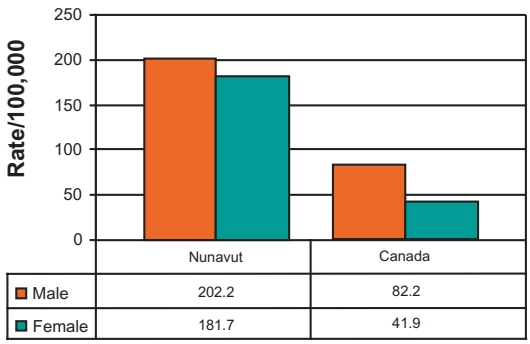
Fig. 5.1 Incidence Rates of Lung Cancer in Nunavut

Rates adjusted for the 1996 gender distribution of Nunavut's population.
Three-year rolling averages used. See note 4.
See notes 1 and 5

Due to the small population size, Nunavut's lung cancer incidence trend fluctuates over time, however, it would appear that lung cancer rates are on the rise in Nunavut.

In addition, it appears that the rate of lung cancer in females is becoming closer to that of males over time.

Gender



	Nunavut	Canada
Male	202.2	82.2
Female	181.7	41.9

Fig. 5.2 Age-Adjusted Rates of Lung Cancer by Gender, Nunavut vs. Canada

See note 1, 2 and 3.

Rates of lung cancer are similar for men and women in Nunavut. This differed from the gender profile of lung cancer in Canada where the rates for women are one half that of men[1]. Internationally, lung cancer rates for women are even lower[4].

An analysis of lung cancer in circumpolar Inuit from 1996 indicated that the rates of lung cancer in Canadian Inuit women were particularly high when compared to the rates of Inuit men in Canada. In fact rates of lung cancer in Canadian Inuit women even exceeded those of men in other circumpolar populations such as Alaska and Greenland[3].

Age

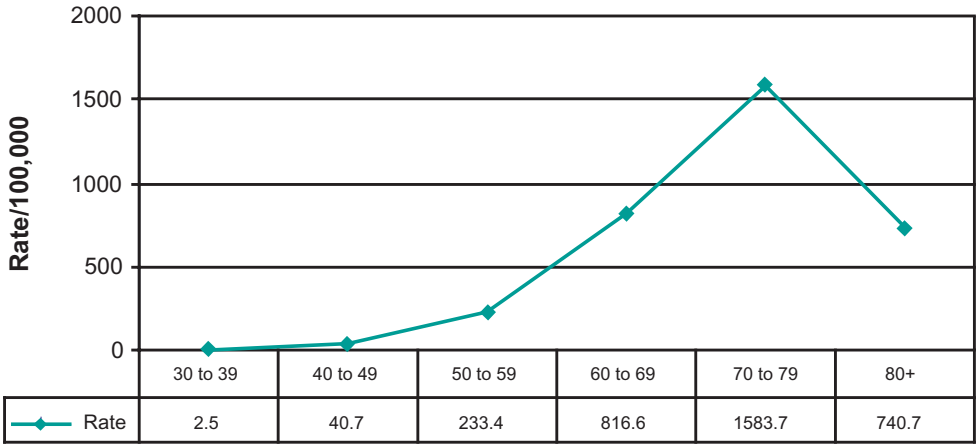


Fig. 5.3 Age-Specific Incidence Rates of Lung Cancer in Nunavut

Rates adjusted to the 1996 age-distribution of Nunavut's population. See note 1.

Lung cancer incidence tends to occur in older age groups. The bulk of lung cancer cases in Canada, approximately 89%, occurred after the age of 60[1]. In Nunavut the bulk of lung cancer cases, approximately 92% occurred after the age of 50. It is a concern that Nunavummiut appear to develop lung cancer 10 years younger than their southern counterparts.

The mortality rate for lung cancer is high. In Nunavut, the average survival time is 10.4 months.

Ethnicity

The difference in lung cancer incidence is significantly higher in Inuit than in non-Inuit. Of 142 cases, only 3 occurred in non-Inuit. Factors could include a higher smoking rate in Inuit than in non-Inuit. In 1999 it was estimated that 70.4% of Inuit smoked, whereas only 33.4% of non-Inuit smoked[5]. In addition, as mentioned previously, a significant out-migration of the non-Inuit population at the age of 55 may also be a factor play a role in this difference.

Discussion

An increased risk of developing lung cancer has been linked primarily to tobacco consumption, as well as exposure to environmental tobacco smoke. The prevalence of smokers remains high among Nunavummiut. It has been estimated that 62% of Nunavummiut smoke – a rate higher than anywhere else in the country[6].

Other risk factors could include exposure to local air pollution such as smoke from indoor lamps and stoves and carving dust (which can contain asbestos, and silica, known carcinogens), and the duration and intensity of smoking behavior[3].

The Government of Nunavut has recently introduced legislation aimed at reducing exposure to environmental tobacco smoke in public places in an attempt to combat lung cancer.

CERVICAL CANCER IN NUNAVUT

There were 75 cases of malignant and in situ cervical cancer that were reported in the 10 year period in Nunavut. This represents nearly 30% of all cancers reported in women in Nunavut.

The national data presented only take into consideration invasive (malignant) cervical cancer. Approximately 7% of cervical cancers reported in Nunavut were malignant. In Nunavut, the rate of malignant cervical cancer, 7.9/100,000, is lower than the national rate, 9.2/100,000.

The data in this section show both aspects of the disease: malignant and in situ.

Invasiveness

In situ cancers are localized lesions that have not invaded beyond the epithelial layer. If left untreated, in situ malignancies may eventually progress to become invasive cancers and even metastasize to other body sites.

The frequency of diagnoses of in situ cervical cancers reflects the positive effects of cervical cancer screening programs, which allows detection at an early stage.

Of a total of 75 reported cases of cervical cancer in Nunavut, 70 were classified as in situ and the remaining 5 were classified as malignant. The age-specific rates of the disease are 59.3/100,000 women for in situ cervical cancer and 4.2/100,000 women for malignant cervical cancer (see note 6). The frequency of diagnoses of in situ cervical cancers reflects the positive effects of cervical cancer screening programs, which allows detection at an early stage.

Trend

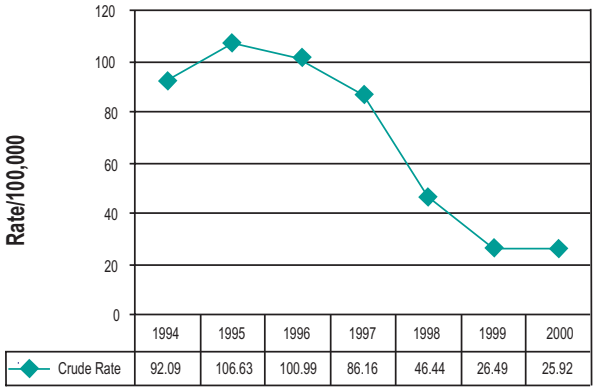


Fig. 6.1 Incidence Rate of all Cervical Cancer, Malignant and In Situ

Three-year rolling averages used. See note 4.
See note 6.

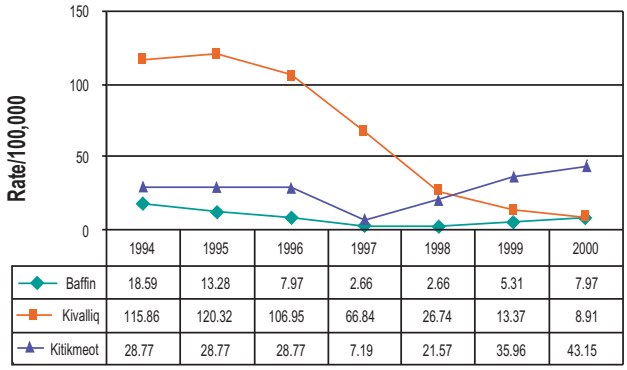


Fig. 6.2 Incidence Rates of Cervical Cancer, Malignant and In Situ, by Region

Three-year rolling averages used. See note 4.
Rates adjusted for the 1996 gender distribution of Nunavut's population.
See note 6.

In Canada, the incidence of cervical cancer has been declining gradually since 1984. Between 1992 and 1999, the rate of malignant cervical cancer incidence declined by 1.3/100,000[1].

In Nunavut, incidence of cervical cancer declined sharply between 1992 and 1998 where the rate of malignant and in situ cervical cancers combined decreased by 7/100,000.

The high number of cervical cancer cases in Nunavut from 1994 to 1997 appears to be driven by the incidence of this cancer in the Kivalliq in the early 90's. It is uncertain why this peak occurred and pap screening data is not available for this timeframe, however, it is important to note that the rates in the Kivalliq have since decreased to the present trend.

Age

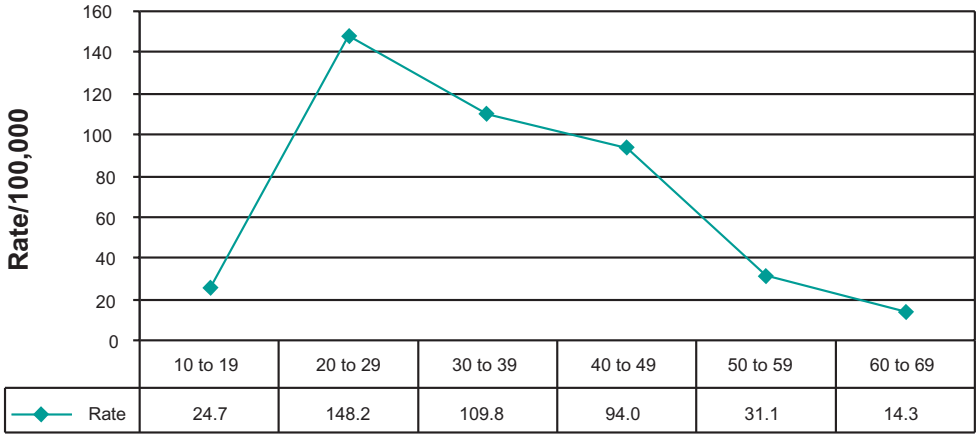


Fig. 6.3 Age-Specific Incidence Rates of Cervical Cancer in Nunavut, Malignant and In Situ

Rates adjusted to the 1996 age distribution of Nunavut's female population.
See notes 1 and 6.

After gender, age is the single most important determinant of cancer occurrence, with incidence usually increasing as the population ages. The exception to this is in situ cervical cancer where higher rates occur in younger people. Unlike some of the other major cancers, cervical cancer seems to be primarily a disease of younger adults. The distribution of cervical cancer in Nunavut reveals that the majority (75%) were diagnosed between the ages of 20 and 39.

In Nunavut, the youngest age at which the invasive disease was diagnosed was 31. Nationally, cervical cancer is only captured for malignant incidence. In Canada the incidence peaks at the 35[1].

Ethnicity

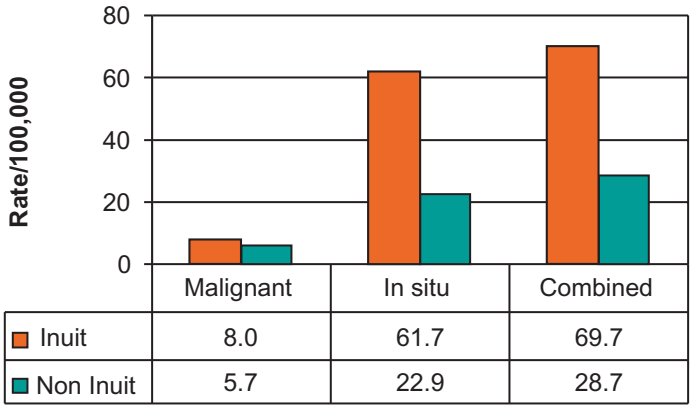


Fig. 6.4 Incidence Rates of Cervical Cancer by Ethnicity

Rates adjusted to the 1996 ethnic distribution of Nunavut's population.
See notes 1 and 6.

High rates of cervical cancer have been reported in other Canadian and American aboriginal populations [7, 8]. The incidence of cervical cancer among Alaskan Native women was found to be four to five times higher than for non-natives[9]. Similarly, the rates among Greenland Inuit were six times higher than among Danish women[10]. In Nunavut, the rates in Inuit were more than double those of non-Inuit, however this was not a statistically significant difference.

Screening for Cervical Cancer

% of ♀	1998	1999	2000	2001
Baffin	40.9	41.5	42.5	45.3
Kivalliq	40.2	39.2	33.2	33.6
Kitikmeot	31.0	42.1	36.4	49.3
Nunavut	**38.8**	**40.9**	**38.6**	**42.6**

Table 6.5 One-Year Pap Testing Rates for Women 15-69, 1998-2001, by Region

	1998-2000	% of ♀
Baffin	2200	51.8
Kivalliq	1120	45.8
Kitikmeot	769	49.5
Nunavut	4089	49.6

Table 6.6 Three-Year Pap Testing Rates for Women 20-69, by Region, 1998-2000

Province	% of ♀
BC	67
Man.	69
NS	74
PEI	71
Nunavut	50

Source: Health Canada. Cervical Cancer Screening in Canada. 1998

Table 6.7 Three-Year Pap Testing Rates for Women 20-69, by Province, 1996-1998

Although we have made notable gains in reducing the numbers of invasive cervical cancer, it remains that this year, in excess of 1400 new cases will be diagnosed in Canada and 420 Canadian women will die of a disease that is preventable[11].

On average, about 40% of eligible women are screened annually. However, in a three-year period only 10% more women got screened, making Nunavut's screening rates lower than most provinces. Consideration needs to be given to a more coordinated approach to reaching most eligible women.

Discussion

Cancer of the cervix is a preventable disease and, theoretically, with regular screening, precursor lesions can be detected early and invasive disease can be prevented.

Infection with the sexually transmitted Human papillomavirus (HPV) is now recognized as the main cause of cervical cancer[12].

Although we have made notable gains in reducing the numbers of invasive cervical cancer, it remains that this year, in excess of 1400 new cases will be diagnosed in Canada and 420 Canadian women will die of a disease that is preventable[11].

Infection with HPV is not a typical sexually transmitted infection in that condom use has shown no protective effect[13]. Prevention by immunization against certain HPV types is still in the experimental stages, which further highlights the need for an effective screening strategy[14].

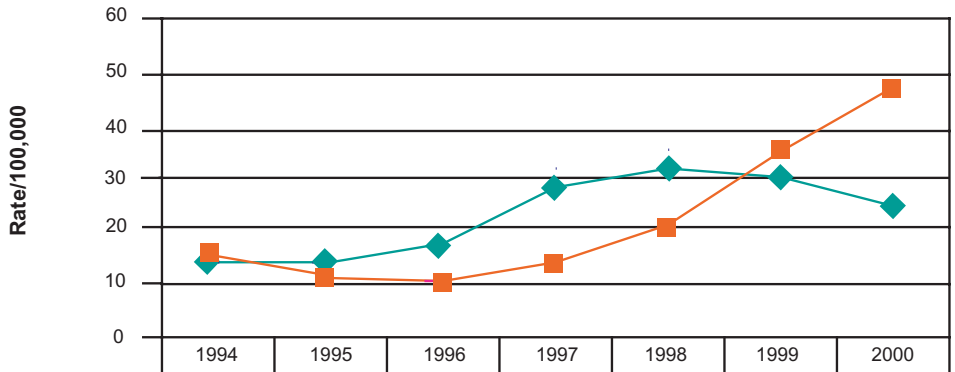
In the last few years a number of new technologies have become available that will undoubtedly benefit the health of individual women and the Nunavut Department of Health and Social Services is currently evaluating their use for a comprehensive screening strategy.

COLORECTAL CANCER IN NUNAVUT

A national committee on colorectal cancer screening recently reviewed the latest evidence on screening. They recommended fecal occult blood testing (testing stool for blood) for all Canadians 50-74 every two years and any positive tests be followed up by a colonoscopy[18].

A total of 57 cases of colorectal cancer were diagnosed in the 10-year period, which accounted for nearly 16% of all malignant cancers reported in Nunavut.

Trend



	1994	1995	1996	1997	1998	1999	2000
Males	13.0	12.5	17.2	28.9	33.4	30.7	23.1
Females	14.5	11.3	11.0	13.5	21.2	36.0	47.9

Fig. 7.1 Incidence Rates of Colorectal Cancer

Three-year rolling averages used. See note 4.
See note 5.

It appears that colorectal cancer incidence is increasing over time. This differs from the national picture where the incidence of colorectal cancer is relatively stable[1].

Gender

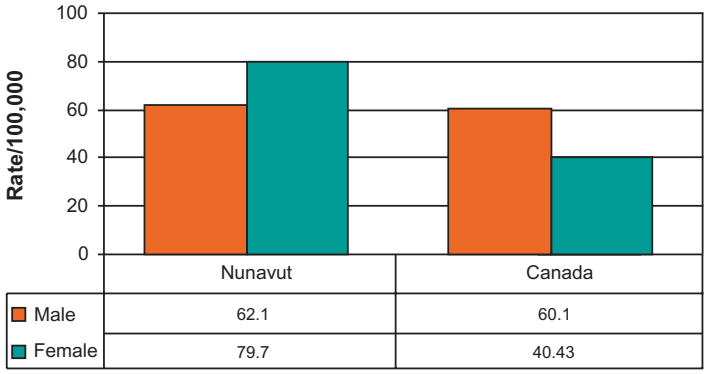


Fig. 7.2 Age-Adjusted Rates of Colorectal Cancer Incidence by Gender, Nunavut vs. Canada

See notes 1, 2 and 3.

The distribution of colorectal cancer between genders is similar. Nationally and globally, colorectal cancer incidence is usually higher for men than for women[1, 15]. Nunavut currently has colorectal cancer incidence rates for women that are higher than those reported in most of the world[4], and studies of colorectal cancer indicate that historically, the incidence rates among female Inuit in Alaska and Canada were among the highest reported in the world[15, 16].

Age

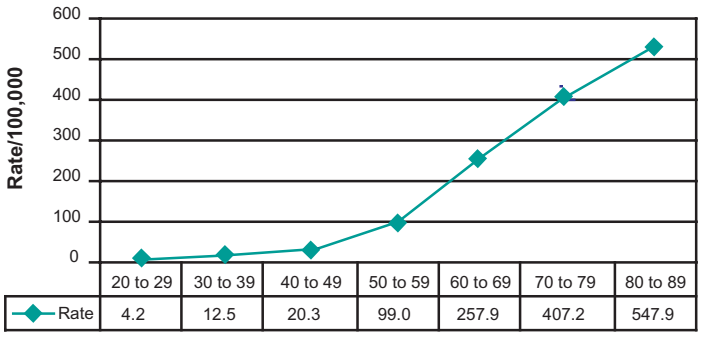


Fig. 7.3 Age-Specific Incidence Rates of Colorectal Cancer in Nunavut

Rates adjusted to the 1996 age distribution of Nunavut's population. See notes 1 and 7

There is an interesting difference in the age distribution colorectal cancer between Nunavut and Canada. In Canada, most colon cancers are diagnosed after the age of 70[1], however, in Nunavut, approximately 70% of colon cancers occur before the age of 70 and a significant amount (21%) were diagnosed before the age of 50. This prompts the need for more research into risk factors and screening for this population.

Ethnicity

There were no statistically significant differences of observed colorectal cancer occurrence between Inuit and non-Inuit in the 10-year period examined for this report.

Discussion

A diet rich in fiber is thought to protect against colon cancer. Factors that increase the risk are believed to be a diet rich in total and saturated fats, animal and total proteins, especially red meat, and refined carbohydrates and sugars, increased dietary iron, low intakes of calcium, and total calories as well as a sedentary lifestyle. Evidence is limited with respect to the effectiveness and practicality of some strategies for the primary prevention of cancer. Attention has been focused, as a result, on opportunities for secondary prevention (i.e., screening), which aims to detect the disease at an early, treatable stage and thus to reduce rates of morbidity and mortality. A national committee on colorectal cancer screening recently reviewed the latest evidence on screening. They recommended fecal occult blood testing (testing stool for blood) for all Canadians 50-74 every two years and any positive tests be followed up by a colonoscopy[17].

BREAST CANCER IN NUNAVUT

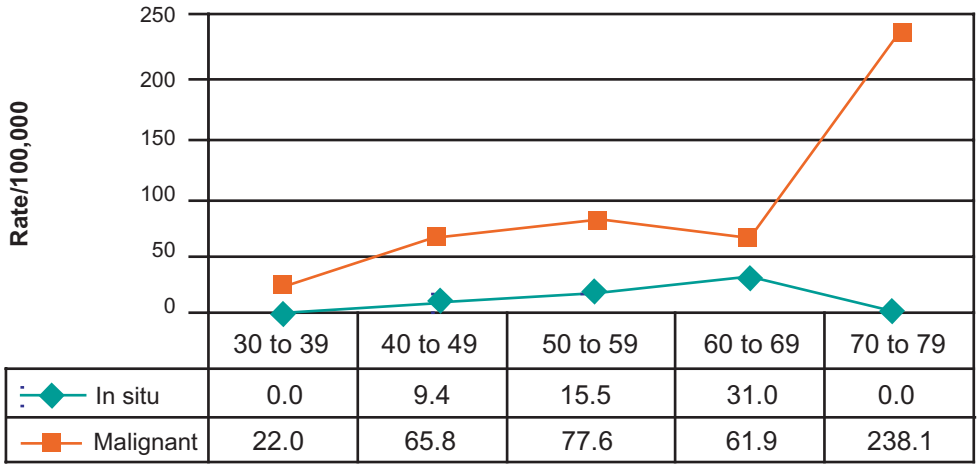
There were 20 cases of malignant breast cancer reported in the 10-year time period, comprising just over 11% of all cancer incidence in the female population of Nunavut.

The rate of breast cancer in Nunavut women for the period between 1992 and 2001 was 35.2, which is much lower than the 1996 national rate of 98.5[1].

Invasiveness

Approximately 87%, of breast cancer incidence in Nunavut is detected at the invasive (malignant) stage.

Age



	30 to 39	40 to 49	50 to 59	60 to 69	70 to 79
In situ	0.0	9.4	15.5	31.0	0.0
Malignant	22.0	65.8	77.6	61.9	238.1

Fig. 8.1 Age-Specific Incidence Rates of Breast Cancer in Nunavut

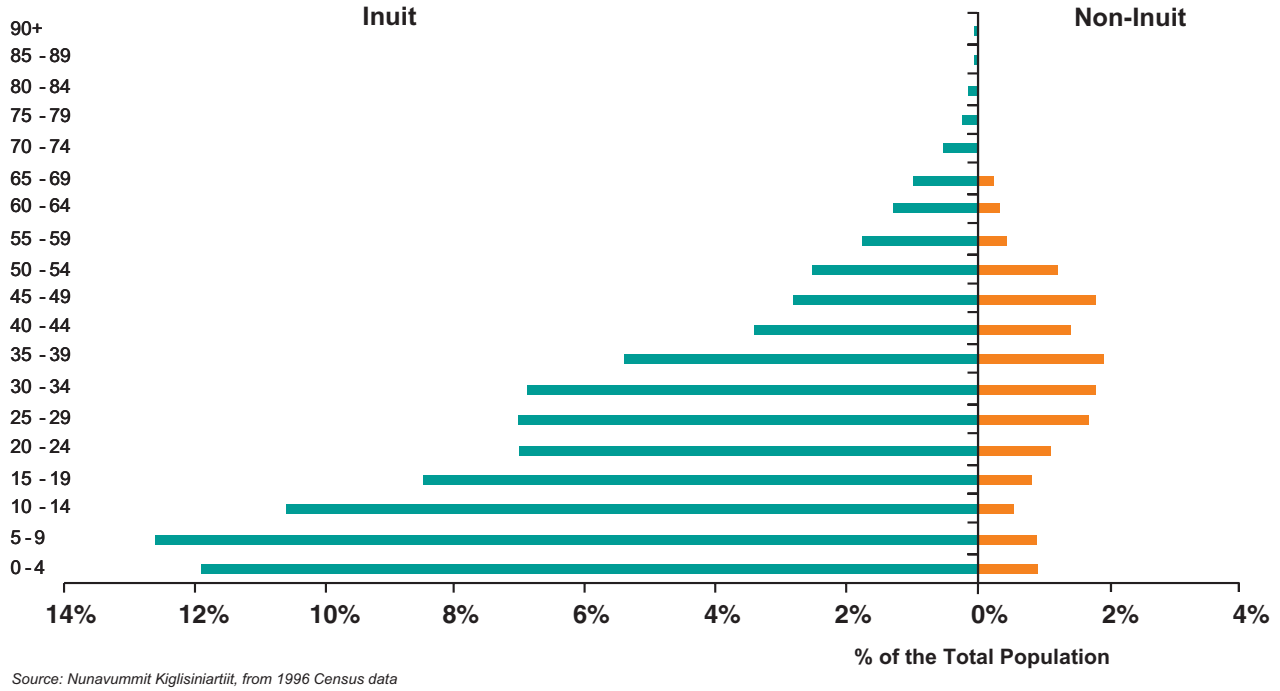
Rates adjusted to the 1996 age distribution of Nunavut's population.
Drop in population numbers after age 69 make rates of that age unreliable. See Appendix B.
See notes 1 and 7.

Breast cancer cases in Nunavut were diagnosed in patients between the ages of 34 and 79. Overall, incident cases occur at a younger age than they do nationally.

The age distribution of breast Cancer is somewhat different that that of the rest of Canada. In Nunavut, about 78% of women with breast cancer were younger than 60 when they are diagnosed whereas in Canada, only 28% of women were diagnosed with breast cancer before the age of 60[1].

Ethnicity

The rate /100,000 of malignant breast cancer adjusted to the ethnic distribution of Nunavut's population in 1996 was 12.9 in Inuit and 40.1 in non-Inuit. The rate of breast cancer in non-Inuit women is more than 3 times higher than it is in Inuit women. However, the sample size of non-Inuit women was small, and the difference not found to be statistically significant.



Source: Nunavummit Kiglisiniartiit, from 1996 Census data

Fig. 8.2 Age/Ethnicity Pyramid: Nunavut, 1996

In order for a screening to be cost-effective, it must meet some minimal criteria. First, the disease has to occur frequently, and cause substantial morbidity and/or mortality. Second, a detectable, pre-clinical phase has to be identified. Third, the natural history of the disease has to be known. Fourth, successful treatment has to be possible for the disease in its preclinical phase. Finally, the screening process has to be relatively non-invasive, reliable and economically feasible[22].

The rate in non-Inuit women (40.1/100,000) is less than half that seen in the rest of the country. Breast cancer typically occurs in the over 55 year-olds among non-Inuit women in the rest of Canada, see Fig. 8.2. In Nunavut, there is a significant out-migration after age fifty-five and therefore any significant difference between Inuit and non-Inuit could be missed.

Discussion

Historically, few countries have had breast cancer rates as low as those of the Canadian Inuit[18]. The low incidence of breast cancer among Inuit women may be explained by higher fertility and breast feeding rates, both of which have some protective effect against breast cancer[19].

Screening for breast cancer can be accomplished either with mammography, or with breast self-examination. While it is generally agreed that mammography decreases breast cancer death the degree of effectiveness of mammography is a controversy[20]. The efficacy of breast self-examination (BSE) is also uncertain because the evidence from clinical trials is limited. Preliminary studies offer contradictory evidence in its ability to decrease breast cancer deaths[21].

The Canadian and American Cancer Societies and the Canadian Task Force on Preventive Health Care all recommend a screening mammogram at least every two years and a clinical breast exam every year for women aged 50 to 69, but experts also disagree about the starting age and frequency.

A secondary prevention strategy for Nunavut must take into consideration the incidence rate as well as the evidence that the majority of cases reported have been diagnosed at the invasive stage.

In order for a screening to be cost-effective, it must meet some minimal criteria. First, the disease has to occur frequently, and cause substantial morbidity and/or mortality. Second, a detectable, pre-clinical phase has to be identified. Third, the natural history of the disease has to be known. Fourth, successful treatment has to be possible for the disease in its preclinical phase. Finally, the screening process has to be relatively non-invasive, reliable and economically feasible[22].

NASOPHARYNGEAL CANCER IN NUNAVUT

In Nunavut, cancer of the nasopharynx accounted for 5.6% of reported cancers between 1992 and 2001. In Nunavut, the rate of nasopharyngeal cancer was 14.6/100,000 for men and women combined.

In Canada, nasopharyngeal cancers are quite rare, with a rate of 0.6/100,000 for men and women combined[1]. Worldwide, rates of nasopharyngeal cancer are low – around 1/100,000, except in certain high-risk populations. Rates like those observed in Nunavut are only seen in a couple of distinct Asian populations[4, 23].

Gender

Nearly twice as many males developed nasopharyngeal cancer in Nunavut compared to females. This is in keeping with incidence ratios that were observed among Circumpolar Inuit[23].

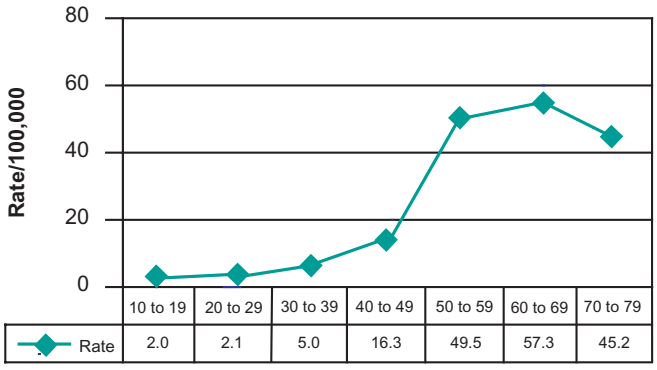


Fig. 9.1 Age-Specific Incidence Ratesof Nasopharyngeal Cancer in Nuanvut

Rates adjusted to the age distribution of Nunavut's 1996 population. See note 1.

Age

In Nunavut, cases of nasopharyngeal cancer appear to occur at relatively young ages, however, this is difficult to adequately assess this because of the relatively small number of cases.

Nasopharyngeal cancer is relatively rare in most parts of the world. In populations where it is common, it tends to occur at an early age (15 to 24 years)[23]. The Nunavut data would tend to support this.

Ethnicity

In Nunavut, all cases of nasopharyngeal cancer diagnosed in the 10-year period between 1992 and 2001 were found in Inuit patients. The numbers were too small to determine if this was indeed significant and more research needs to be done to assess a possible genetic predisposition.

Discussion

Among the Nunavut sample, nasopharyngeal cancer occurred exclusively among Inuit. It has been suggested that some ethnic groups, mainly from Southeast Asia and Southern China, have a genetic predisposition to the disease[23]. Studies of Inuit patients with nasopharyngeal cancer in Alaska and Greenland have shown that there is a consistent association with the Epstein-Barr Virus (EBV) based on the detection of viral markers (EBV-DNA or nuclear antigens) in the malignant cells and a characteristic EBV-serology[23]. No work of this nature has yet been undertaken in Nunavut.

GLOSSARY

95% Confidence Interval: The range of values within which, 95% of the time, the true value would fall. The wider the range, the fewer the number of cancer cases and the more the numbers fluctuate. For example, if the 95% confidence interval is 1.0-15.0, the uncertainty is larger than if the confidence interval is 1.5-1.7.

Age: In epidemiology, the age at which the cancer was diagnosed.

Age-Specific Rate: The number of cases /100,000 persons per year for a specific, narrow age range. Five year age groups are commonly used.

Age Adjusted Rate: A procedure where weighted averages of age-specific rates are used to modify rates to a standard population in order to minimize the effects of differences in the age composition of given populations when comparing rates for these populations. The purpose of this rate is to compare groups of people from different backgrounds and age structures, for example when comparing breast cancer between countries, a world population is used, so that the difference in incidence rates is not due to one country having older citizens. The age-standardized for both sexes combined also adjusts for differences in gender distribution.

Comparative Incidence Figure (CIF): A ratio of the age-standardized incidence rate for a disease in a specific area compared with the incidence rate for all of Canada. Those areas with a CIF less than one have an incidence rate that is less than the Canadian average. If the CIF is above one, then the area has a higher rate of disease than the rest of Canada.

Crude Rate: The number of new cases due to a disease over the total population that could be affected, without considering age or other factors. It is usually expressed as a rate /100,000 persons per year.

Incidence: The number of new cases of disease during a period of time.

Standard Population: A population distribution that is used to create rates that have the same structure, so that rates can be properly compared.

Statistical Significance: A method that tests whether the result given is so rare that it is unlikely to be due to chance alone. Examples include a p-value (for probability). The most common cut-off is 5%, that is if this result would occur by chance only one in twenty times, it would be considered to be significant.

Source: Health Canada. Population and Public Health Branch. Surveillance and Risk Assessment Division. Cancer Surveillance On-line: http://cynthera.ic.gc.ca/dsol/cancer/index_e.html2.

NOTES

1. Unless otherwise stated Nunavut's data is calculated based upon all cases that occurred between 1992 and 2001.
2. Age-standardized incidence rates /100,000 using the 1991 Canadian Standard Population.
3. Unless otherwise stated, Canadian rates are from 1996, because it was in the middle of the period of Nunavut's data.
4. A rolling average combines data over several years of observations in order to limit wide fluctuations in data which often occur in small populations[21].
5. Data on trends in Nunavut begin in 1994 to allow for a feed-in period.
6. Denominator includes only female component of Nunavut's population. Technically, it should include only women over age 15, however, this data is not available from the 1996 census.
7. In cervical and breast cancer, rates are /100,000 population of women. In prostate cancer rates are /100,000 population of men.

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APPENDIX A

Health Canada Site Groupings

Health Canada Grouping	SEER Grouping	ICD-9
Bladder	Urinary Bladder	188
Bone	Bones and Joints	170
Brain and Other Nervous System	Brain and Other Nervous System	191, 192
Breast	Breast	174
Cervix	Cervix Uteri	180
Colon and Rectum	Colon and Rectum & Anus, Anal Canal and Anorectum	153, 154
Esophagus	Esophagus	150
Gallbladder	Gallbladder	156
Hodgkin's Disease	Hodgkin's Lympoma	201
Kidney	Kidney and Renal Pelvis	189
Larynx	Larynx	161
Leukemias	Leukemia	204-208
Liver	Liver and Intrahepatic Bile Duct	155
Lung	Lung and Bronchus	162
Melanoma	Melanoma of the Skin	172
Multiple Myeloma	Myeloma	203
Nasopharynx	Nasopharynx	147
Non-Hodgkin's Lymphoma	Non-Hodgkin's Lymphoma	200, 202
Ovary	Ovary	183
Pancreas	Pancreas	157
Pleura	Pleura	163
Prostate	Prostate	185
Salivary Gland	Salivary Gland	142
Small Intestine	Small Intestine	152
Stomach	Stomach	151
Testis	Testis	186
Thyroid	Thyroid	193
Uterus	Corpus Uteri	182

Source: Health Canada. Population and Public Health Branch. Surveillance and Risk Assessment Division. Cancer Surveillance On-line: http://cynthera.ic.gc.ca/dsol/cancer/index_e.html

APPENDIX B

Population of Nunavut, 1992-1996, 5-Year Age Groups

Year	Sex	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
1992	M	1846	1504	1219	1033	1192	1249	1020	756	668	486	342	290	189	114	64	37	24	7
1992	F	1734	1442	1129	995	1154	1157	868	646	499	402	317	231	148	85	60	34	17	12
1993	M	1869	1540	1293	1074	1158	1283	1078	813	678	530	347	300	188	128	76	33	21	12
1993	F	1712	1518	1167	1023	1128	1190	923	678	512	427	329	247	166	88	61	29	18	11
1994	M	1865	1658	1332	1113	1135	1306	1183	857	696	582	377	297	205	129	82	33	22	16
1994	F	1742	1573	1235	1058	1095	1217	996	701	533	442	348	259	171	99	65	31	20	13
1995	M	1862	1714	1368	1165	1108	1284	1217	895	731	614	412	319	224	133	86	43	18	23
1995	F	1759	1617	1249	1118	1082	1215	1031	720	540	468	347	264	195	113	53	32	23	16
1996	M	1923	1746	1404	1212	1127	1283	1241	948	763	632	431	339	243	132	88	49	19	24
1996	F	1764	1648	1288	1141	1099	1222	1054	768	554	510	356	288	205	118	53	31	20	18
1997	M	1891	1829	1424	1219	1113	1274	1235	974	715	654	482	320	239	146	90	51	20	23
1997	F	1708	1716	1337	1144	1067	1233	1060	760	581	536	364	284	191	137	64	32	17	17
1998	M	1889	1879	1435	1275	1114	1262	1237	1013	727	653	550	294	254	162	93	57	22	24
1998	F	1733	1725	1407	1186	1068	1182	1115	814	585	567	370	311	177	153	69	34	20	14
1999	M	1884	1906	1535	1283	1123	1241	1224	1087	711	667	601	297	246	181	94	56	24	28
1999	F	1665	1782	1483	1257	1116	1132	1136	876	589	601	393	307	183	151	70	38	21	14
2000	M	1855	1964	1624	1305	1162	1232	1231	1126	733	671	663	313	238	192	97	57	30	29
2000	F	1655	1804	1555	1280	1202	1128	1160	922	624	610	451	278	185	158	89	30	23	16
2001	M	1683	1998	1701	1320	1209	1191	1227	1118	778	654	745	358	220	200	81	77	40	32
2001	F	1549	1785	1634	1302	1251	1144	1199	979	676	641	577	270	209	116	116	44	15	20

Source: Statistics Canada

APPENDIX C

1991 Canadian Standard Population

Age Group	Population
0-4	6946.4
5-9	6945.4
10-14	6803.4
15-19	6849.5
20-24	7501.6
25-29	8994.4
30-34	9240
35-39	8338.8
40-44	7606.3
45-49	5953.6
50-54	4764.9
55-59	4404.1
60-64	4232.6
65-69	3857
70-74	2965.9
75-79	2212.7
80-84	1359.5
85+	1023.7

APPENDIX D

Canadian Adaptation of the WHO Principles of Early Disease Detection

1. The condition should be an important health problem
2. The natural history of the condition, including development from latent to declared disease, must be understood. There should be a recognizable latent (asymptomatic) period or early symptomatic stage.
3. There should be a suitable screening test or examination.
4. The overall benefit of the screening program should outweigh the potential harms from its application.
5. The test (inclusive of screening and diagnosis) and the screening program should be acceptable to the population.
6. Evidence-based recommendations should be available regarding who should be offered further diagnostic investigation and/or treatment and the choices available to them.
7. Treatment or intervention that improves survival or quality of life (compared with not screening) should be available for patients with recognized disease.
8. Adequate staffing and facilities for recruitment, testing, diagnosis and follow-up, treatment, and program management should be available.
9. The resources allocated to the screening program (including testing, diagnosis and treatment of patients diagnosed) should be economically balanced in relation to other health care priorities.

Source: Coombs A, Jones-McLean E, Le-Petit c, Flanagan W, White K, Berthelot J-M, Villeneuve P. Technical Report for the National Committee on Colorectal Cancer Screening. Ottawa. Health Canada, Statistics Canada. http://www.hc-sc.gc.ca/pphb-dgspsp/publicat/ncccs-cndcc/techrep_e.html.