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CANCER IN GREENLANDIC INUIT 1973–1997: A COHORT STUDY

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The increasing westernization of the Arctic countries may influence the very particular cancer profile of these populations. Our objective was to investigate the development in cancer incidence from 1973 to 1997 in a large and well-defined Inuit population in Greenland. Greenland is part of the Danish Kingdom, and population statistics covering both countries are available from the same registry resource. Data from the Danish Civil Registration System and from the Danish Cancer Registry were used to calculate age-standardized cancer incidence rates for the periods 1973–1987 and 1988–1997 for persons born in Greenland. Using rates for Denmark, sex-specific standardized incidence ratios (SIRs) for 1988–1997 were calculated. Furthermore, age- and sex-specific incidence rates in the 2 periods were calculated for selected cancers. Total cancer incidence increased from 248.5 to 277.9 per 100,000 person-years in men and from 269.4 to 302.2 per 100,000 person-years in women. The incidence of lung, stomach, breast and colon cancer increased, whereas the incidence of cervical cancer decreased. Compared to the Caucasian population in Denmark, high SIRs were found for cancers of the nasopharynx, salivary gland, esophagus, stomach and cervix and low SIRs for testis, bladder, prostate, breast and hematologic cancers. Overall cancer incidence among Greenlandic Inuit is increasing as a result of increases in several cancers that are common in Western populations. A significant increase in the incidence of stomach cancer in both sexes, which contrasts global trends for this cancer, warrants further investigation.

Key words: *Greenland; Inuit; cancer incidence; epidemiology; stomach cancer*

In the beginning of the twentieth century, malignant diseases in the Inuit were virtually nonexistent.[1] Living in an isolated part of the world, the Inuit traditionally exhibit a distinctive cancer pattern characterized by high frequencies of NPC and salivary gland carcinoma and low frequencies of tumors common in Western countries, such as cancers of the breast, skin, prostate and the hematologic system.[2,3] During the second half of the twentieth century, the Inuit populations in Greenland, Canada and Alaska have undergone transitions which in most Western societies have taken several hundred years, including rapid urbanization (in 1999 17% of the population lived in settlements compared to 41% in 1960), shifting of the work force from traditional to modern occupations (in the 1980s more than half of the workforce was employed in public administration, service and trade) and marked changes from a diet based mainly on sea mammals toward a more Western diet.[4–6] This rapid sociocultural change in a genetically homogeneous population is unequaled and has already led to an increase in diseases believed to be associated with a Western lifestyle, such as obesity, diabetes and cardiovascular diseases.[7–9] Earlier reports from the Arctic regions indicated a beginning change in the overall pattern of cancer, with an increase in the frequency of "Western" tumors, along with a reduction in the frequency of traditional Inuit tumors.[2,10,11]

In the circumpolar region, the Inuit people constitute approximately 130,000 individuals, of whom 56,245 (as of 2001) live in Greenland. Using population-based registries in Greenland and Denmark, we present a comprehensive analysis of the cancer pattern in Greenland during 1973–1997. Our objective was to provide precise estimates of cancer rates and to assess the extent to which the increasing westernization has influenced the pattern of neoplastic disease in the Inuit.

MATERIAL AND METHODS

Study population

All individuals in Greenland and Denmark are registered in the CRS. The CRS was established in Denmark on 1 April 1968 and in Greenland on 1 June 1972, when all persons alive and resident were registered and given a unique personal identification number (the person number). The CRS includes information on date of birth, place of birth, sex, time of death or emigration and vital status (continuously updated). The person number is used as key ID in virtually all registries, which facilitates high-quality linkages between the different registries.

A Greenlander was defined as a person born in Greenland. No final definition of a Greenlander exists, but the vast majority of individuals born in Greenland are Inuit; *e.g.,* 92% of children born in Greenland during 1973–1987 had parents born in Greenland. Based on the CRS, information on all individuals born in Greenland and alive on 1 January 1973 or later was retrieved, a total of 72,331 individuals.

In 1973, 55% of the population were below 20 years of age and 9.9% were above 50 years of age compared to 34.1% and 15.4%, respectively, in 1997.

Identification of cancer cases

Information on cancer cases was retrieved from the DCR.[12] Reporting of cancer cases to the DCR is mandatory in both Greenland and Denmark, and since 1975, the main source of information in the registry has been notifications from physicians diagnosing and treating cancer patients, supplemented by information from pathology reports and death certificates. Information in the registry on cancer cases in Greenland before 1975 was obtained from a study based on review of patient records from all hospitals in Greenland.[13] Cases diagnosed before 1978 were coded according to the slightly expanded ICD-7 code used by the DCR[12] and cases diagnosed after 1978, according to both the ICD-O code and the modified ICD-7 code. Cancers in Greenlanders living in Denmark at the time of diagnosis were included. Analyses are based on the ICD-7 code, except for carcinoma *in situ* of the cervix, where the ICD-O classification is used. The analysis of

Abbreviations: CI, confidence interval; CRS, Civil Registration System; DCR, Danish Cancer Registry; HPV, human papillomavirus; NHL, non-Hodkin's lymphoma; NPC, nasopharyngeal carcinoma; RR, relative risk; SIR, standardized incidence ratio; TURP, transurethral resection of the prostate.

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TABLE I – STUDY POPULATION, DISTRIBUTION OF PERSON-YEARS AND NUMBER OF CANCERS ACCORDING TO GENDER, 1973–1997

	Population[1]	Person-years		Number of cancers	
		1973–1987	1988–1997	1973–1987	1988–1997
Men	36,186	371,305	283,056	500	500
Women	36,145	381,688	294,625	734	764

[1]Born in Greenland.

carcinoma *in situ* of the cervix is therefore restricted to 1978–1997.

Statistical analysis

The follow-up period started 1 January 1973 or at date of birth, whichever occurred last, and ended at the date of cancer diagnosis, death, emigration, disappearance or 31 December 1997, whichever occurred first. The person number linked the cohort of 72,331 persons to the DCR, and all cases of cancer were retrieved, including benign brain tumors, papillomas of the bladder and carcinoma *in situ* of the cervix, diagnosed between 1973 and 1997.

Sex-specific crude and age-standardized (world standard population) cancer incidence rates in Greenland were calculated for the 2 periods 1973–1987 and 1988–1997. These periods were chosen to represent an early and a late period with a near equal number of cases and thus equally stable rates. Because of the limited number of observations, 5-year calendar intervals were not used.

The expected number of cancers in Greenland in 1988–1997 was calculated by applying age- and period-specific incidence rates from Denmark (excluding Greenland) to the cohort at risk in the period 1988–1997. Ratios of observed to expected cancers (SIRs) were used equivalent to the RR and calculated for cancers with at least 5 cases in the Greenlandic cohort. The 95% CIs were calculated using Byars approximation.[14]

Possible trends in incidence rates were evaluated statistically for cancers with more than 100 cases (both sexes) and for sex-specific cancers with more than 50 cases. The relative change per 5 years and 95% CIs was estimated using log-linear Poisson regression. If a statistically significant trend over successive 5-year periods was observed, the sex- and age-specific incidence rates were calculated and presented for the 2 periods 1973–1987 and 1988–1997.

RESULTS

In total, 36,186 men and 36,145 women were born in Greenland and alive in the period 1973–1997 (Table I). During the 25-year period, 1,000 cancers among men and 1,498 cancers among women were diagnosed (Table I), and 14.6% of the cancers were diagnosed in persons living in Denmark at the time of the diagnosis. Overall, 78% of the cancers were verified histologically, with no change over time. In 1988–1997, cancers at unknown or not specified sites (ICD-7 199) constituted 4.0% of all cancers in both men and women.

Table II shows the relative change in incidence rates (not age-standardized) per 5 years. Incidence rates for all cancers combined in the period 1973–1997 increased by approximately 4% for men and 6% for women per 5 years. Significant trends for both sexes combined were observed for cancers of the stomach (24%) and lung (23%) and, among women, for breast cancer (14%) and cervix uteri (–10%). No significant trends were observed for cancers of the nasopharynx, esophagus, colon and ovary.

Between 1973–1987 and 1988–1997 the age-standardized rate for all cancers combined increased by 11.8% in men, from 248.5 to 277.9 per 100,000 person-years, and in women by 12.2%, from 269.4 to 302.2 per 100,000 person-years (Table III). During 1988–1997, cancers of the lung, stomach and esophagus were the 3 predominant types among men, whereas cancers of the lung, breast and cervix were the predominant types among women.

TABLE II – RELATIVE CHANGE IN INCIDENCE RATES PER 5 YEARS (RR_{5YEAR}) IN THE PERIOD 1973–1997, ADJUSTED FOR AGE

Site[1]	RR_{5year}	95% CI
Both sexes		
Nasopharynx	0.93	0.82–1.07
Esophagus	1.01	0.89–1.15
Stomach	1.24	1.07–1.43
Colon	1.12	0.99–1.27
Lung	1.23	1.14–1.31
Females		
Breast	1.14	1.04–1.26
Cervix	0.90	0.83–0.98
Ovary	0.99	0.83–1.17
CIS cervix[2]	0.96	0.88–1.04
All malignant neoplasms		
Male	1.04	1.00–1.09
Female	1.06	1.02–1.10

[1]Only cancer sites with more than 100 cases in both sexes or 50 cases in a single sex.–[2]Carcinoma *in situ,* not included in all malignant neoplasms, 1978–1997.

Table IV shows the site-specific SIR during the period 1988–1997 for Greenlanders compared to the Danish population. Among Greenlanders, a marked excess was observed for NPC in both men and women. In addition, significant excesses were observed for cancers of the esophagus, salivary glands, stomach, lung and pancreas in both sexes; for cancers of the cervix uteri, gallbladder and mouth in women; and for cancer of the liver in men. A significant deficit was observed for cancers of the brain, bladder and skin in both sexes; cancers of the breast and corpus uteri as well as leukemia in women; and cancers of the testis and prostate as well as Hodgkin's disease in men.

Age-specific incidence rates in 1973–1987 and 1988–1997 for cancers with significant 5-year trends are illustrated in Figure 1. For all cancers combined, increases in incidence rates were primarily seen among men older than 70 years and women older than 50 years. The marked increase in stomach cancer rates was in both sexes observed in the age group above 50 years. The marked increase in lung cancer rates was mainly seen among women from age 50 years and onward and among the oldest men. The increase in breast cancer rates among women was solely due to an increase in rates among women above 50 years of age. The decrease in cervix uteri cancer rates was seen among women aged 30–49 years.

DISCUSSION

Ever since the first studies in the 1950s on cancer incidence among the Inuit,[11,13] studies have demonstrated an increasing cancer burden.[2,3,10] The present population-based study documents a 5-year increase in the number of cases among Greenlanders of 4% and 6% in men and women, respectively, with increases in cancers of the lung, breast, colon and stomach and decreases in cancer of the cervix. With the exception of stomach and cervical cancer rates, the change in the overall pattern is consistent with the leading forms of cancer seen in Western populations.

Judged by the percentage of unknown or unspecified cancers (4.0%), cancer registration in Greenland is comparable to that in many European countries, including Denmark (4.0–4.3%), Ireland (4.2–5.1%) and Poland (4.3–4.7%).[15]

The proportion of histologically verified cancers is 12–14% lower in Greenland than in Denmark[16,17] and probably reflects the lack of biopsy possibilities in more remote areas of Greenland. This could affect the reliability of diagnoses for rare cancers.

Lung cancer is strongly associated with smoking, and the development in lung cancer rates among Inuit most likely reflects changes in smoking prevalence. The import of cigarettes to Greenland has increased from 5.2 cigarettes per inhabitant daily in 1950 to 11.1 in 1980.[4] Although import statistics indicate decreasing

TABLE III – NUMBERS OF CANCERS AND INCIDENCE RATES PER 100,000 PERSON-YEARS IN GREENLAND BY GENDER IN 1973–1987 AND 1988–1997

Site	ICD codes[1]	Males						Females					
		1973–1987			1988–1997			1973–1987			1988–1997		
		Count	Crude rate	AS rate[2]	Count	Crude rate	AS rate[2]	Count	Crude rate	AS rate[2]	Count	Crude rate	AS rate[2]
Salivary glands	142	9	2.4	3.8	9	3.2	3.9	11	2.9	3.8	6	2.0	2.1
Mouth	143, 144	10	2.7	5.4	5	1.8	3.0	4	1.0	1.6	8	2.7	3.2
Nasopharynx	146	34	9.2	14.7	21	7.4	10.3	30	7.9	11.2	22	7.5	8.0
Other pharynx	145, 147–148	14	3.8	6.7	12	4.2	6.6	3	0.8	1.2	8	2.7	3.6
Esophagus	150	36	9.7	19.6	39	13.8	21.9	25	6.6	10.4	20	6.8	8.7
Stomach	151	18	4.8	8.0	43	15.2	22.1	19	5.0	7.4	22	7.5	9.2
Colon	153	26	7.0	15.5	30	10.6	18.2	42	11.0	18.6	48	16.3	21.3
Rectum	154	18	4.8	9.4	15	5.3	9.7	15	3.9	5.7	16	5.4	6.7
Liver	155.0	12	3.2	5.5	11	3.9	8.0	3	0.8	1.2	6	2.0	2.9
Gallbladder and other biliary	155.1	4	1.1	1.8	5	1.8	3.3	8	2.1	3.5	15	5.1	6.4
Pancreas	157	17	4.6	11.6	22	7.8	11.4	21	5.5	7.6	26	8.8	11.5
Nasal cavities and sinuses	160	4	1.1	1.7	0	0.0	0.0	4	1.0	1.5	1	0.3	0.5
Larynx	161	3	0.8	1.5	5	1.8	2.9	1	0.3	0.4	1	0.3	0.5
Lung	162.0–162.1	123	33.1	63.5	133	47.0	80.4	75	19.7	32.2	134	45.5	58.3
Mediastinum	164	1	0.3	0.6	3	1.1	1.4	4	1.0	1.6	1	0.3	0.4
Breast	170	1	0.3	0.6	0	0.0	0.0	102	26.7	35.0	121	41.2	46.4
Cervix uteri	171	—	—	—	—	—	—	154	40.5	48.7	113	38.5	36.8
Corpus uteri	172	—	—	—	—	—	—	9	2.4	3.7	5	1.7	2.1
Uterus, unspecified	173–174	—	—	—	—	—	—	4	1.0	1.4	2	0.7	0.7
Ovary	175	—	—	—	—	—	—	37	9.7	13.7	29	9.9	10.3
Prostate	177	5	1.3	2.7	3	1.1	2.0	—	—	—	—	—	—
Testis	178	8	2.2	2.3	3	1.1	1.0	—	—	—	—	—	—
Kidney	180	14	3.8	6.8	22	7.8	11.3	21	5.5	8.9	15	5.1	6.7
Bladder, including papilloma	181	12	3.2	6.2	9	3.2	4.5	7	1.8	2.7	6	2.0	2.6
Melanoma of skin	190	2	0.5	0.6	2	0.7	1.1	0	0.0	0.0	5	1.7	2.0
Other skin	191	13	3.5	6.9	16	5.7	7.8	9	2.4	3.6	15	5.1	6.3
Brain and nervous system	193	12	3.2	3.2	11	3.9	5.2	23	6.0	7.7	20	6.8	7.0
Thyroid	194	4	1.1	1.5	1	0.4	0.4	9	2.4	2.9	9	3.1	3.0
Bone	196	1	0.3	0.2	2	0.7	1.1	2	0.5	0.6	1	0.3	0.4
Connective tissue	197	3	0.8	0.7	2	0.7	1.1	3	0.8	0.9	4	1.4	1.4
Other and unspecified sites	199	27	7.3	14.3	20	7.1	11.4	31	8.1	12.4	31	10.5	13.5
Non-Hodgkin's lymphoma	200, 202	9	2.4	3.7	15	5.3	6.7	7	1.8	2.1	9	3.1	3.2
Hodgkin's disease	201	2	0.5	0.5	1	0.4	0.2	2	0.5	0.4	4	1.4	1.4
Multiple myeloma	203	3	0.8	1.6	3	1.1	1.9	3	0.8	1.4	4	1.4	1.2
Leukemia	204	7	1.9	2.3	12	4.2	4.3	12	3.1	3.7	3	1.0	1.0
All other sites	—[3]	48	12.9	25.6	25	8.8	15.2	34	8.9	12.5	33	11.2	13.8
All malignant neoplasms	140–205	500	134.7	248.5	500	176.7	277.9	734	192.3	269.4	764	259.4	302.2

[1]ICD, 7th revision.–[2]Directly age-adjusted using world standard.–[3]ICD codes 140, 141, 152, 156, 158, 159, 162.2, 176, 179, 192, 195, 198, 205.

consumption in the 1990s, 80% of the adult population in 1993 smoked.[18] The increase in lung cancer rates is particularly pronounced among women. A similar development has been observed in Alaska.[10] Lung cancer incidence in men and women in Greenland is among the highest in the world; and with a latency period of several decades between smoking and cancer development,[19] the lung cancer epidemic in Inuit women may not have reached its peak.

With the rapid westernization and sociocultural development in Greenland over the past decades, there have been considerable changes in dietary exposures. Earlier, the diet consisted mainly of meat from marine mammals and fish, with very little carbohydrates or vegetable matter but rich in unsaturated fatty acids.[20] The main part of the diet today consists of imported food. The main energy sources in earlier times were protein and fat, but these have now been replaced by fat and carbohydrates.[3] The westernization of the diet is probably partly responsible for the increase in colon cancer among the Inuit, which is now comparable to the incidence in the Danish population. Although fat intake is now equivalent to that of Western societies, the traditional Inuit diet still eaten is rich in monounsaturated fatty acid and *n*-3-polyunsaturated fatty acids of marine origin,[21,22] which has been hypothesized to have a protective effect against, *e.g.,* breast cancer.[23]

A surprising finding is the clear increase in stomach cancer rates, especially in men. In recent decades, stomach cancer has declined globally; and increasing rates, as observed in Greenland, are unparalleled in industrialized countries.[24] A small increase among Inuit men over the last 20 years has been observed in Alaska,[10] and high but falling rates of stomach cancer are found in populations from Iceland and northern Scandinavia.[15,25] Improved diagnostic possibilities, especially access to endoscopic procedures, could explain an increase over time but would not explain the large relative increase among men compared to women. Likewise, a parallel increase in esophageal cancer rates of the same magnitude would have been expected. Furthermore, diagnostic procedures are not better than in, *e.g.,* Denmark, where the incidence was half that found among the Inuit. In Greenland, a high nitrosamine content has been found in certain dried, unsalted fish preparations;[26] but there is no indication of increased consumption of these traditional foods, whereas consumption of vegetables and fruit, which have a protective effect, has increased.[24] The association between *Helicobacter pylori* and noncardia stomach cancer

TABLE IV – SIR IN GREENLAND COMPARED TO DENMARK, 1988–1997

Females			Males		
Site[1]	SIR	95% CI	Site[1]	SIR	95% CI
Nasopharynx	47.5	29.8–71.9	Nasopharynx	27.3	16.9–41.8
Esophagus	5.7	3.5–8.8	Salivary glands	6.5	3.0–12.3
Salivary glands	4.5	1.7–9.9	Esophagus	4.2	3.0–5.8
Gallbladder and other biliary	3.3	1.8–5.4	Stomach	2.9	2.1–4.0
Cervix uteri	2.6	2.1–3.1	Liver	1.9	1.0–3.5
Mouth	2.4	1.1–4.8	Pancreas	1.7	1.1–2.6
Stomach	2.2	1.4–3.4	Lung	1.6	1.3–1.8
Lung	2.1	1.7–2.5			
Pancreas	1.9	1.2–2.7			
Liver	1.5	0.5–3.2	Gallbladder and other biliary	1.8	0.6–4.3
Thyroid	1.3	0.6–2.5	Kidney	1.2	0.8–1.8
Connective tissue	1.2	0.3–3.1	Mouth	0.9	0.3–2.1
Kidney	1.1	0.6–1.9	Colon	0.8	0.5–1.1
Colon	1.0	0.7–1.3	Non-Hodgkin's lymphoma	0.7	0.4–1.2
Hodgkin's disease	0.8	0.2–1.9	Rectum	0.6	0.3–1.0
Ovary	0.8	0.6–1.2	Leukemia	0.6	0.3–1.1
Rectum	0.8	0.4–1.3	Larynx	0.5	0.2–1.1
Multiple myeloma	0.7	0.2–1.8	Connective tissue	0.5	0.1–1.9
Non-Hodgkin's lymphoma	0.5	0.2–1.0	Multiple myeloma	0.5	0.1–1.4
Larynx	0.4	0.0–2.1			
Breast	0.6	0.5–0.7	Brain and nervous system	0.3	0.2–0.6
Brain and nervous system	0.6	0.4–0.9	Other skin	0.2	0.1–0.3
Bladder	0.3	0.1–0.7	Bladder	0.2	0.1–0.4
Leukemia	0.2	0.0–0.5	Melanoma of skin	0.1	0.0–0.3
Corpus uteri	0.2	0.1–0.4	Testis	0.1	0.0–0.3
Other skin	0.1	0.1–0.2	Hodgkin's disease	0.1	0.0–0.7
Melanoma of skin	0.1	0.0–0.3	Prostate	0.1	0.0–0.2

[1]Only cancer sites with at least 5 cases observed.

appears well established.[27] The seroprevalence of *H. pylori* in Greenland is unknown, but a high seroprevalence of CagA-positive *H. pylori* has been observed in a Canadian Arctic community.[28] As no time series on the seroprevalence are available in Greenland or other Inuit communities, the role of *H. pylori* in the stomach cancer rate increase cannot be estimated, though a large increase in *H. pylori* seroprevalence appears unlikely in light of the sociocultural changes in the country. Smoking increases the risk of stomach cancer, especially in *H. pylori*–infected individuals.[29,30] The large increase in stomach cancer rates in men is, however, not accompanied by similar increases in male lung cancer rates, as the large increase in female lung cancer rates is not accompanied by increases in female stomach cancer rates. In conclusion, the significant increase in stomach cancer rates in Greenlandic Inuit is unexplained and needs further investigation.

The incidence of breast cancer in Inuit women has increased markedly over the past 25 years. Despite this, the risk of breast cancer in the Inuit is still approximately half of that in the Danish population. The increase is observed in women older than 50 years, and the overall pattern has changed from a typical low-risk one with stagnating or falling rates after menopause to one commonly seen in Western countries with increasing rates after menopause.[24] Most of the ethnic and international differences in the risk of breast cancer can be explained by differences in environmental exposures and lifestyle, particularly reproductive and hormonal factors. The birth rate has been steadily falling, and the maternal mean age at first birth increased from 20.5 years in 1973 to 24.0 years in 1997,[31] both factors known to increase the risk of breast cancer.[24] Increased risk of breast cancer has also been associated with obesity after menopause and large weight gains after the age of 18 years. Time series of body weights and other indicators of obesity are not available for Greenland, but the prevalence is expected to increase in parallel with the development in other Inuit populations, where obesity and Type 2 diabetes are escalating problems.[8,32] An additional explanation for at least part of the increasing rate could be changes in the pattern of breast-feeding. Thus, prolonged breast-feeding may be associated with a decreased risk of breast cancer in both pre- and postmenopausal women.[33,34] In Greenland, prolonged breast-feeding, practically continued through the childbearing years, was common in the beginning of the twentieth century[35] but decreased throughout the century; and the pattern of breast-feeding is now similar to what is seen in Western populations.[4] Diagnostic improvements in the period could also contribute to the increase in breast cancer rates. This would, however, be expected to influence rates in all age groups and not specifically in postmenopausal women.

Low parity, late age at first birth and obesity are risk factors that are shared with 2 other hormone-associated cancers, corpus uteri and ovarian cancers. Compared to the Caucasian population in Denmark, cancer of the uterus is rare among the Inuit, whereas the risk of cancer of the ovary is comparable to Danish figures. The fact that incidence rates of these 2 cancers among the Inuit have not increased in parallel with breast cancer rates indicates that factors other than those associated with reproductive history may also be important for the increasing incidence in breast cancer.

A significant decreasing trend for cancer of the cervix was observed, whereas no significant trend for cervical carcinoma *in situ* was evident. However, compared to Danes the risk of cancer of the cervix in the Inuit is still high. Women in Greenland have more sexual partners and earlier age at first intercourse than Danish women[36] but similar rates of HPV infection in cervical lesions.[37] A possible explanation could be that HPV infections in Inuit women are of a more chronic and persistent nature than those observed in Danish women.[36] Rates of cervical cancer well above the general rates in the United States and Canada are also seen in Inuit populations in Alaska and northern Canada. Parallel with the development in Greenland, the incidence of cervical cancer among the Inuit in Alaska has declined markedly since 1983.[38]

Rates of prostate cancer remain very low compared to Caucasian populations, and the increase in rates seen in other low-risk areas like Singapore, Hong Kong and Japan is not observed among the Inuit.[24] TURP and determination of prostate-specific antigen

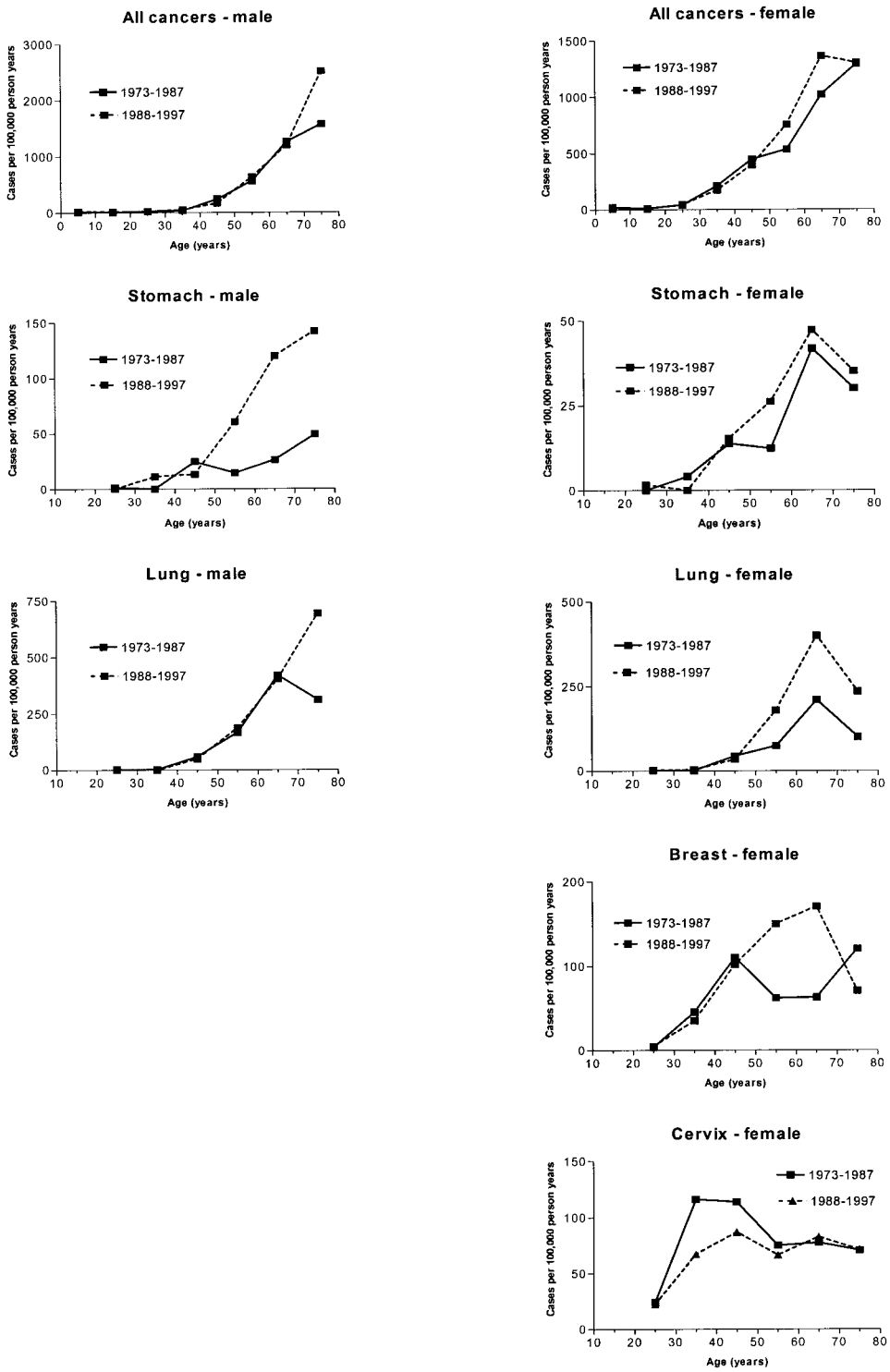

FIGURE 1 – Age-specific (10-year intervals) incidence rates, 1973–1987 and 1988–1997, for males and females. All cancers and cancers with significant 5-year trends.

are not widely used in Greenland, and underestimation of the frequency is possible. Despite that, an increase in rates would have been expected due to the dietary changes mentioned above as consumption of a Western-style diet has been associated with an increased risk of prostate cancer.[24]

Rates of other traditionally low-incidence cancers among the Inuit, such as testis cancer and hematologic cancers except NHL, also remain low and appear to be partly resistant to the marked social changes that have taken place in Greenland.

In contrast to most other populations around the world, high incidence rates of NPC and salivary gland carcinoma are found among the Inuit in Greenland and the other Arctic regions. Other NPC high-incidence areas include parts of Southeast Asia and North Africa. In Greenland, the majority of NPCs are of the undifferentiated type,[13] and both diseases are believed to be influenced by environmental factors (especially Epstein-Barr virus) but to be associated with a particular genetic constitution.[39] For the last 20 years, a significant decrease in rates of

NPC has been observed in Hong Kong, whereas other high-incidence areas have not experienced similar changes in incidence.[40] Although rates of the 2 cancers in Greenland showed a minor decrease during the period, no significant trend was observed, and rates compared to Caucasian populations remain high. This indicates exposure to risk factors that have not changed or changed in a too recent time period to influence the incidence of these cancers.

The age distributions in the Inuit societies are changing as the proportion of elderly increases. The increasing number of elderly in the cancer-prone age groups is partly responsible for the increasing cancer burden, indicated by the large increase in overall crude rates compared to age-standardized rates. This development combined with increases in absolute rates of a variety of cancers, in particular lung, stomach, colon and breast cancers, constitutes a significant challenge for Greenlandic society in the decades to come.

Incidence rates of NPC and salivary gland carcinoma in the Greenlandic population continue to be among the highest in the world, despite the significant changes that have taken place in their lifestyle and environment. This argues for a strong influence of genetic factors in the etiology of these cancers. The high and increasing incidence of stomach cancer is in contrast to the global development for this cancer and needs further attention.

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