

CANCERS OF SKIN, BONE, CONNECTIVE TISSUES, BRAIN, EYE, THYROID AND OTHER SPECIFIED AND UNSPECIFIED SITES IN INUIT

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Low rates of skin cancer, both melanoma and non-melanoma, were observed in Inuit after 20 years of observation. Tumours of the brain and central nervous system, of the thyroid, bone and connective tissues and other specified sites occurred with rates similar to those in comparison populations in Denmark, Connecticut and Canada. These findings support that neither UV and ionizing radiation from nuclear fall-out, nor pollution of herbicides and pesticides in the Arctic area have yet had any noticeable impact on cancer risk. However, unspecified and secondary neoplasms constitute 7-8% of the total Circumpolar cancer incidence and the pattern of rare cancers must be interpreted with caution. Increased diagnostic efforts with a higher precision in the future are warranted.

The cancers dealt with in this paper constitute a heterogeneous group. Of the possible risk factors mentioned by Lanier (1), Nielsen & Storm (2) and Gaudette et al. (3) in particular the Asian heritage of the Inuit, the Arctic environment and the performance and constitution of health services in terms of sub-optimal diagnostic possibilities are important. Since cancers of the brain and nervous system, bone and connective tissues, the thyroid and all the 'other specified sites' (4) are rare even in populations of a substantial size, the Inuit rates in a population below around 110 000 become even more unstable. However, in view of the interesting high rates of cancers of the salivary glands, nasopharynx (5) and of the nasal cavities (6) in Inuit, rare cancers are worth studying in these populations, with a view to further studies on the carcinogenic process.

Material and Methods

Cancer incidence data from 1969 to 1988 from the Inuit populations of Alaska, Canada and Greenland were collected and compiled into a standard format for the purpose of this analysis. The definitions, methods and data sources are fully described previously (4). The accompanying site-specific tables give, by calendar period, country and sex, the total number, crude rate, age-standardized incidence rate (ASR), cumulative rate up to and including the age of 64 (Cum 64) and standardized incidence ratio (SIR), (or indirect standardized rate) to the comparison populations of Connecticut (USA), Canada and Denmark. Age-specific rates are presented for the combined Circumpolar area for the 20-year study period as a whole. Basis of diagnosis is given for the 20 years by region. In the following, the results for each site are dealt with separately followed by a brief discussion.

Melanoma of skin (ICD-9 172)

Results. Only six cases of melanoma of the skin in women and two in men were reported in the entire Circumpolar region from 1969 to 1988, with ASRs of 1.1 and 0.3 respectively (Table 1). This places the Inuit among the low-risk populations of the world (7). Consequently, in both sexes for the total time period, the SIRs were very low. There was no change in incidence over time.

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Table 1

Cancer in Circumpolar Inuit 1969–1988 by site (ICD 9). Total number of cases, crude-, age standardized (ASR world)- and cumulative (Cum 64) incidence rates by sex and region. Standardized incidence ratios (SIR) and 95% confidence interval (95% CI) compared with Connecticut, Denmark and Canada

172 Melanoma of skin		Total No.	Crude rate	ASR world	Cum 64	Connecticut		Denmark		Canada	
						SIR	95% CI	SIR	95% CI	SIR	95% CI
Males	Circumpolar	2	0.2	0.3	0.0	0.0	0.0–0.1	0.0	0.0–0.2	0.1	0.0–0.2
	Alaska	1	0.3	0.4	0.0	0.0	0.0–0.3	0.1	0.0–0.4	0.1	0.0–0.4
	Greenland	1	0.2	0.3	0.0	0.0	0.0–0.2	0.1	0.0–0.3	0.1	0.0–0.4
	Canada	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
Females	Circumpolar	6	0.6	1.1	0.1	0.1	0.0–0.2	0.1	0.0–0.2	0.1	0.1–0.3
	Alaska	4	1.2	2.2	0.2	0.2	0.1–0.6	0.2	0.1–0.5	0.3	0.1–0.7
	Greenland	1	0.2	0.4	0.0	0.0	0.0–0.2	0.0	0.0–0.2	0.1	0.0–0.3
	Canada	1	0.4	0.8	0.1	0.1	0.0–0.5	0.1	0.0–0.5	0.1	0.0–0.7

Discussion. It seems likely that the skin pigmentation of the Inuit constitutionally protects them against melanoma of the skin, constitutional factors being very relevant in the etiology of this cancer (8, 9). It remains to be seen whether the increase in ultraviolet radiation exposure associated with the ozone holes over the Arctic will result in any change in this situation.

Skin excluding melanoma of skin (ICD-9 173)

Results. Only two cancers of this site were registered in Alaska, one each in both sexes in 1984–1988, while in Greenland 9 cases were reported in women and 13 in men, and Canada reported 5 cases in women and 6 in men (Table 2). Many cancer registries do not register this site, but of those that do, only registries in China and Japan have as low rates as in the Inuit (7). The rates in Denmark and Canadian registries are substantially higher, thus the SIRs for the Inuit are very low, with the upper 95% CIs substantially below 1.0.

Discussion. Non-melanoma skin cancer is strongly related in Western populations to chronic sunlight exposure as well as to some occupational factors, exposures not common among Inuit. With the destruction of the ozone layer in the Arctic, however, exposure of Inuit to carcinogenic ultraviolet radiation will probably increase. It would be desirable, therefore, to monitor closely the trends of skin tumours (both melanoma and non-melanoma) among Inuit closely in the future.

Brain and central nervous system (ICD-9 191, 192)

Results. There were 36 brain and CNS cancers reported in women and 28 in men in the whole Circumpolar region over the 20 year-period of the study (Table 3). Although the ASRs for these sites were low, they are not very different from many of the reported rates from registries around the world (7). The SIRs have to be interpreted with caution, given the inclusion of benign brain tumours in the

Greenland and Denmark data, and their exclusion in Canada and the United States. When the appropriate SIRs are used (comparing Alaskan rates with Connecticut, Greenland rates with Denmark and Canadian Inuit rates with Canada), most of the SIRs are seen to be less than 1.0, though most of the upper 95% CIs are greater than one. In women, more cases were reported overall, though not in Canada; some of the rates in Greenland in women were higher than in men. Indeed, except for in 1974–1978, when only two cases were reported, the SIR for Greenland women approximated to 1.0 in comparison with Denmark.

Discussion. The etiology of tumours of the brain and central nervous systems is largely unknown, except for some occupational exposures which can be expected to be rare in the Inuit. Although the ASRs fluctuate wildly with time (Figs 1, 2), there is a suggestion of an increase of incidence with time, perhaps particularly in women, as has been seen in some registries elsewhere (10). Increasing trends for brain tumours in many countries appear in part to be related to improvement in diagnosis, with separation of brain tumours from haemorrhagic strokes (11). This separation may be more advanced in Greenland than in Canadian Inuit, and perhaps also so in Alaska.

Thyroid (ICD-9 193)

Results. In Western populations, thyroid cancer is much commoner in women than in men (7), and this differential appears also in the Inuit (Table 4). Although the number of cases was small (with 27 thyroid cancers reported in women and 7 in men in the whole Circumpolar region over the 20-year period of the study), the ASRs for Alaskan and Greenlandic Inuit were similar to those in many other countries, except those for Iceland, which are surprisingly high, while ASRs for Canadian Inuit were low. In women, most of the cases were reported from Alaska and Greenland, only two from Canada. In the 20 years studied, the SIRs approximated to 1.0, with no evidence of a trend. There were no thyroid cancers reported in 1969–1973 and

Table 2

Cancer in Circumpolar Inuit 1969–1988 by site (ICD 9). Total number of cases, crude-, age standardized (ASR World)- and cumulative (Cum 64) incidence rates by sex, region and 5-year period. Standardized incidence ratios (SIR) and 95% confidence interval (95% CI) compared with Connecticut, Denmark and Canada

173 Skin (excl. melanoma of skin) ¹			Total No.	Crude rate	ASR world	Cum 64	Denmark		Canada	
							SIR	95% CI	SIR	95% CI
Males	1969–88	Circumpolar	20	2.0	3.6	0.1	0.1	0.1–0.2	0.1	0.1–0.1
		Alaska	1	0.3	0.5	0.0	0.0	0.0–0.1	0.0	0.0–0.1
		Greenland	13	3.1	6.1	0.1	0.2	0.1–0.3	0.1	0.1–0.2
		Canada	6	2.6	4.8	0.2	0.2	0.1–0.3	0.1	0.0–0.3
	1969–73	Circumpolar	8	3.7	7.8	0.3	0.3	0.1–0.6	0.2	0.1–0.4
		Alaska	0	0.0	0.0	0.0	0.0	–	0.0	–
		Greenland	5	5.1	11.7	0.3	0.5	0.1–1.1	0.3	0.1–0.7
	1974–78	Canada	3	6.4	13.4	0.8	0.6	0.1–1.8	0.4	0.1–1.2
		Circumpolar	0	0.0	0.0	0.0	0.0	–	0.0	–
		Alaska	0	0.0	0.0	0.0	0.0	–	0.0	–
		Greenland	0	0.0	0.0	0.0	0.0	–	0.0	–
	1979–83	Canada	0	0.0	0.0	0.0	0.0	–	0.0	–
		Circumpolar	2	0.8	1.0	0.0	0.0	0.0–0.1	0.0	0.0–0.1
		Alaska	0	0.0	0.0	0.0	0.0	–	0.0	–
		Greenland	2	1.9	2.6	0.0	0.1	0.0–0.3	0.1	0.0–0.3
	1984–88	Canada	0	0.0	0.0	0.0	0.0	–	0.0	–
		Circumpolar	10	3.6	5.9	0.2	0.1	0.1–0.2	0.1	0.1–0.2
		Alaska	1	1.0	1.6	0.1	0.0	0.0–0.2	0.0	0.0–0.2
		Greenland	6	5.3	10.4	0.1	0.2	0.1–0.4	0.2	0.1–0.4
	Females	1969–88	Canada	3	4.4	6.5	0.3	0.2	0.0–0.6	0.2
Circumpolar			15	1.6	2.5	0.1	0.1	0.1–0.2	0.1	0.1–0.1
Alaska			1	0.3	0.6	0.0	0.0	0.0–0.1	0.0	0.0–0.1
Greenland			9	2.2	3.3	0.1	0.1	0.1–0.2	0.1	0.1–0.2
1969–73		Canada	5	2.2	4.0	0.2	0.2	0.1–0.4	0.2	0.1–0.4
		Circumpolar	3	1.4	2.5	0.1	0.2	0.0–0.5	0.1	0.0–0.3
		Alaska	0	0.0	0.0	0.0	0.0	–	0.0	–
		Greenland	2	2.1	3.6	0.2	0.2	0.0–0.8	0.1	0.0–0.5
1974–78		Canada	1	2.3	2.5	0.2	0.3	0.0–1.8	0.2	0.0–1.2
		Circumpolar	3	1.3	2.3	0.1	0.1	0.0–0.3	0.1	0.0–0.3
		Alaska	0	0.0	0.0	0.0	0.0	–	0.0	–
		Greenland	2	2.0	3.1	0.0	0.1	0.0–0.5	0.1	0.0–0.4
1979–83		Canada	1	1.9	3.9	0.5	0.2	0.0–1.1	0.2	0.0–0.9
		Circumpolar	1	0.4	0.7	0.0	0.0	0.0–0.1	0.0	0.0–0.1
		Alaska	0	0.0	0.0	0.0	0.0	–	0.0	–
		Greenland	0	0.0	0.0	0.0	0.0	–	0.0	–
1984–88		Canada	1	1.6	4.8	0.0	0.1	0.0–0.7	0.1	0.0–0.7
		Circumpolar	8	2.9	4.1	0.1	0.1	0.1–0.2	0.1	0.1–0.3
		Alaska	1	1.0	1.8	0.0	0.0	0.0–0.2	0.0	0.0–0.2
		Greenland	5	4.6	6.2	0.2	0.2	0.1–0.4	0.2	0.1–0.4
		Canada	2	3.0	4.1	0.1	0.2	0.0–0.6	0.2	0.0–0.6

¹No rates available for this category for Connecticut

in 1984–1988 in men, and only 7 in the three Inuit populations overall. Of these, only one was reported from Canada. Nevertheless, in spite of the small numbers, the SIRs for men in 1974–1978 in Alaska and Greenland and in 1979–1983 in all three areas approximated to 1.0.

Discussion. The only major cause of thyroid cancer so far identified that could affect the Inuit is exposure to ionizing radiation. There is some reason to be concerned that the exposure of Inuit to radioactive fall-out may be greater than in some other areas of the world, both from

atmosphere testing of nuclear bombs in the 1950s and 1960s and perhaps especially from Chernobyl. However, the latter exposure occurred too recently to have any effect on the reported rates.

Bone (ICD-9 170)

Results. This is a rare cancer in the Inuit with only 6 cases reported overall in women and 9 in men (Table 5), and most, as would be expected, in young people (Table

Table 3

Cancer in Circumpolar Inuit 1969–1988 by site (ICD 9). Total number of cases, crude-, age standardized (ASR world)- and cumulative (Cum 64) incidence rates by sex, region and 5-year time period. Standardized incidence ratios (SIR) and 95% confidence interval (95% CI) compared with Connecticut, Denmark and Canada

191, 192 Brain and CNS ¹			Total No.	Crude rate	ASR world	Cum 64	Connecticut		Denmark		Canada	
							SIR	95% CI	SIR	95% CI	SIR	95% CI
Males	1969–88	Circumpolar	28	2.8	3.1	0.2	0.6	0.4–0.9	0.4	0.3–0.5	0.6	0.4–0.8
		Alaska	7	2.1	2.1	0.1	0.4	0.2–0.9	0.3	0.1–0.6	0.4	0.2–0.8
		Greenland	13	3.1	3.1	0.2	0.6	0.3–1.1	0.4	0.2–0.7	0.6	0.3–1.1
		Canada	8	3.4	4.8	0.3	0.8	0.3–1.5	0.5	0.2–1.0	0.7	0.3–1.4
	1969–73	Circumpolar	8	3.7	3.8	0.3	0.9	0.4–1.7	0.6	0.3–1.2	0.9	0.4–1.7
		Alaska	3	4.2	3.5	0.2	0.9	0.2–2.7	0.7	0.1–1.9	1.0	0.2–2.8
		Greenland	3	3.1	3.7	0.4	0.7	0.1–2.1	0.5	0.1–1.5	0.7	0.1–2.1
		Canada	2	4.3	4.8	0.4	1.0	0.1–3.7	0.7	0.1–2.6	1.0	0.1–3.8
	1974–78	Circumpolar	9	3.8	4.3	0.2	0.8	0.3–1.4	0.5	0.2–1.0	0.8	0.4–1.5
		Alaska	2	2.5	3.2	0.0	0.5	0.1–1.8	0.3	0.0–1.2	0.5	0.1–1.8
		Greenland	5	4.9	4.0	0.2	1.0	0.3–2.3	0.7	0.2–1.6	1.0	0.3–2.4
		Canada	2	3.6	6.0	0.5	0.8	0.1–2.7	0.5	0.1–1.9	0.8	0.1–2.9
	1979–83	Circumpolar	3	1.2	1.1	0.1	0.2	0.0–0.7	0.2	0.0–0.5	0.2	0.0–0.7
		Alaska	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
		Greenland	1	0.9	0.9	0.1	0.2	0.0–1.1	0.1	0.0–0.7	0.2	0.0–1.0
		Canada	2	3.2	2.3	0.1	0.7	0.1–2.6	0.5	0.1–1.7	0.7	0.1–2.4
	1984–88	Circumpolar	8	2.9	3.6	0.2	0.6	0.2–1.1	0.3	0.1–0.6	0.5	0.2–1.0
		Alaska	2	2.0	2.2	0.2	0.4	0.0–1.4	0.2	0.0–0.8	0.3	0.0–1.3
		Greenland	4	3.6	4.1	0.3	0.7	0.2–1.8	0.4	0.1–1.0	0.6	0.2–1.6
		Canada	2	2.9	6.1	0.3	0.6	0.1–2.3	0.3	0.0–1.3	0.6	0.1–2.0
	Females	1969–88	Circumpolar	36	3.8	4.3	0.3	1.0	0.7–1.4	0.5	0.4–0.7	1.0
Alaska			8	2.4	2.1	0.2	0.7	0.3–1.3	0.3	0.1–0.7	0.6	0.3–1.3
Greenland			23	5.7	6.8	0.5	1.5	0.9–2.2	0.8	0.5–1.2	1.4	0.9–2.1
Canada			5	2.2	1.6	0.1	0.7	0.2–1.5	0.3	0.1–0.8	0.6	0.2–1.5
1969–73		Circumpolar	10	4.7	4.7	0.3	1.7	0.8–3.1	0.8	0.4–1.6	1.5	0.7–2.7
		Alaska	3	4.3	2.7	0.1	1.6	0.3–4.6	0.8	0.2–2.3	1.4	0.3–4.0
		Greenland	5	5.1	6.4	0.5	1.8	0.6–4.1	0.9	0.3–2.0	1.5	0.5–3.5
		Canada	2	4.5	2.7	0.1	1.7	0.2–6.3	0.9	0.1–3.1	1.5	0.2–5.4
1974–78		Circumpolar	4	1.7	1.5	0.1	0.5	0.1–1.3	0.3	0.1–0.7	0.5	0.1–1.2
		Alaska	2	2.6	2.1	0.1	0.7	0.1–2.7	0.4	0.0–1.4	0.7	0.1–2.7
		Greenland	2	2.0	1.9	0.2	0.6	0.1–2.0	0.3	0.0–1.0	0.5	0.1–1.9
		Canada	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
1979–83		Circumpolar	9	3.7	4.9	0.4	0.9	0.4–1.7	0.6	0.3–1.0	0.9	0.4–1.7
		Alaska	1	1.2	1.1	0.1	0.3	0.0–1.6	0.2	0.0–1.0	0.3	0.0–1.6
		Greenland	7	6.9	9.1	0.9	1.6	0.6–3.3	1.0	0.4–2.0	1.6	0.6–3.3
		Canada	1	1.6	1.2	0.1	0.5	0.0–2.5	0.3	0.0–1.6	0.5	0.0–2.5
1984–88		Circumpolar	13	4.8	5.7	0.3	1.1	0.6–2.0	0.5	0.3–0.9	1.1	0.6–1.9
		Alaska	2	2.1	2.3	0.2	0.5	0.1–1.8	0.2	0.0–0.9	0.5	0.1–1.7
		Greenland	9	8.3	9.5	0.5	1.9	0.9–3.6	0.9	0.4–1.7	1.9	0.9–3.6
		Canada	2	3.0	2.3	0.1	0.8	0.1–2.8	0.4	0.0–1.4	0.8	0.1–2.8

¹Benign brain tumours are included in the Greenlandic and Danish data.

6). This is also a rare tumour in the world (7). However, the SIRs are greater than 1.0 in Alaska, though less than 1.0 in Greenland and Canada.

Discussion. there are no particular etiologic factors known for these tumours which seem likely to affect Inuit.

Connective tissue (ICD-9 171)

Results. Again this is a rare cancer, with 10 cases in women and 7 in men overall (Table 7). However, the

cancer is also rare in other parts of the world (7). Thus, although the SIRs are usually less than 1.0, the 95% CIs do not exclude the possibility of no difference with the comparison populations.

Discussion. Connective tissue cancers are part of the grouping 'soft tissue sarcomas', suspected in some studies as being increased by exposure to herbicides and pesticides (12), known to accumulate both in the environment and eventually in some of the traditional sources of the Inuit diet. It is reassuring that no obvious increase occurred in

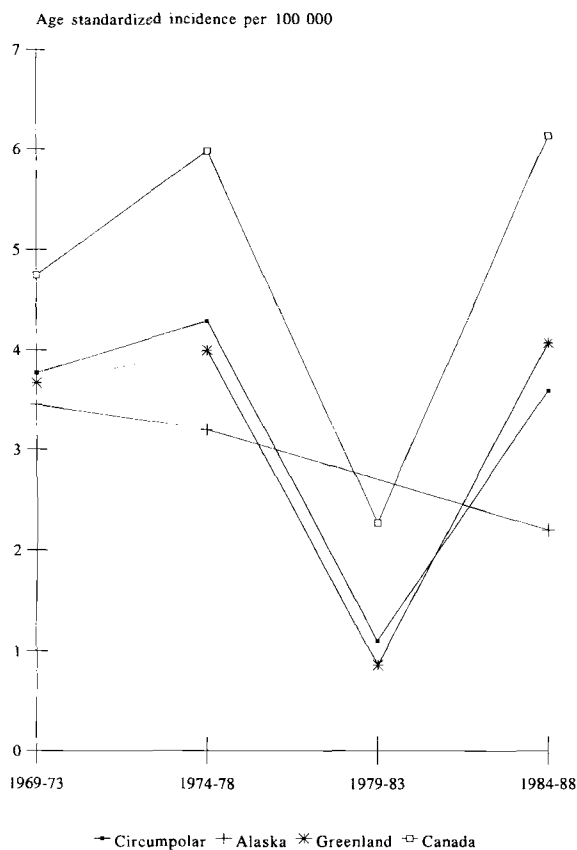


Fig. 1. Trends in cancer incidence among Inuit: ICD9 191,192 Brain and central nervous system, Men.

the incidence of cancers of this site, though in view of their small numbers the confidence to be placed in this observation is probably low.

Eye (ICD-9 190)

Result. Only three cases of eye cancer were reported in men and none in women, including two from Alaska and one from Greenland (Table 8). The two from Alaska were both in the age group 0–4 years, presumably indicating retinoblastomas in infants. The case from Greenland is a malignant melanoma in an Inuit man aged 35–39 years.

Discussion. There are no known etiologic factors for such cancers that would seem to be particularly relevant to the Inuit.

Unspecified and secondary tumours

There were 128 such cancers in women and 122 in men for the whole Circumpolar region, accounting for 7.5 and 7.9% respectively of a total number of cancers, 1 712 in women and 1 538 in men (Table 9). For each Inuit population, the SIRs were significantly greater than 1.0, except for men in Canada. There is no particular indication that

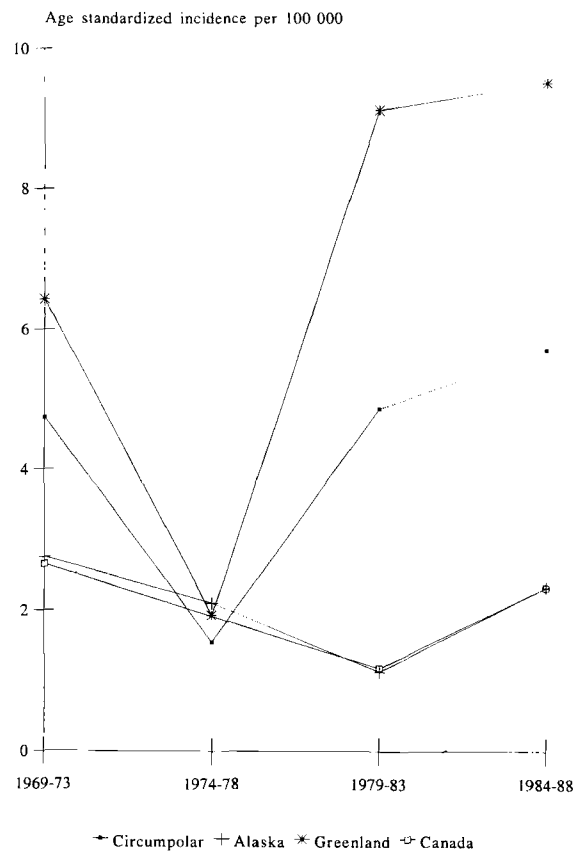


Fig. 2. Trends in cancer incidence among Inuit: ICD9 191, 192 Brain and central nervous system, Women.

the rates of these unspecified tumours decrease with time in either sex. Only 62% were histologically verified (Table 10).

The presence of such large numbers of cancers in these categories suggests that some caution is necessary when attempting to interpret apparently reduced rates in Inuit in sites with small numbers of cancers. Only for sites, such as breast, where it seems unlikely that a major failure to make a diagnosis would occur, is it appropriate to consider the reduced incidence in the Inuit as being confirmed. It is important that in the future every effort be made to reduce unspecified sites and primary unknown cancers to a more reasonable level, recognizing the difficulties of obtaining accurate cancer registration from remote and isolated populations.

Other specified sites

There were 43 cases of cancers in other specified sites in women and 26 in men overall (Table 11). The sites included in this category are: peritoneum and retroperitoneum, ill defined sites of digestive organs, pleura, mediastinum and ill defined sites of thorax, uterus NOS, unspecified female genital organs, urethra and unspecified

Table 4

Cancer in Circumpolar Inuit 1969–1988 by site (ICD 9). Total number of cases, crude-, age standardized (ASR world)- and cumulative (Cum 64) incidence rates by sex, region and 5-year time period. Standardized incidence ratios (SIR) and 95% confidence interval (95% CI) compared with Connecticut, Denmark and Canada

193 Thyroid			Total No.	Crude rate	ASR world	Cum 64	Connecticut		Denmark		Canada	
							SIR	95% CI	SIR	95% CI	SIR	95% CI
Males	1969–88	Circumpolar	7	0.7	1.0	0.1	0.5	0.2–1.1	1.1	0.5–2.3	0.7	0.3–1.4
		Alaska	2	0.6	0.8	0.0	0.4	0.0–1.6	0.9	0.1–3.2	0.5	0.1–2.0
		Greenland	4	1.0	1.3	0.1	0.7	0.2–1.7	1.5	0.4–3.8	0.9	0.2–2.2
		Canada	1	0.4	0.4	0.0	0.4	0.0–2.0	0.8	0.0–4.4	0.5	0.0–2.5
	1969–73	Circumpolar	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
		Alaska	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
		Greenland	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
		Canada	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
	1974–78	Circumpolar	3	1.3	1.5	0.2	0.9	0.2–2.5	2.1	0.4–6.2	1.3	0.3–3.8
		Alaska	1	1.3	1.3	0.1	0.8	0.0–4.6	2.0	0.0–11.0	1.2	0.0–6.9
		Greenland	2	2.0	2.5	0.3	1.3	0.1–4.6	3.2	0.4–11.7	1.9	0.2–7.0
		Canada	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
	1979–83	Circumpolar	4	1.6	2.3	0.2	1.1	0.3–2.9	2.5	0.7–6.3	1.4	0.4–3.5
		Alaska	1	1.1	1.8	0.0	0.8	0.0–4.6	1.7	0.0–9.4	1.0	0.0–5.3
		Greenland	2	1.9	2.7	0.3	1.3	0.1–4.7	2.9	0.3–10.4	1.5	0.2–5.6
		Canada	1	1.6	1.4	0.1	1.3	0.0–7.5	3.0	0.0–16.9	1.6	0.0–9.0
	1984–88	Circumpolar	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
		Alaska	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
		Greenland	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
		Canada	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
Females	1969–88	Circumpolar	27	2.8	3.5	0.3	0.8	0.5–1.2	2.1	1.4–3.0	0.9	0.6–1.3
		Alaska	14	4.3	4.8	0.4	1.2	0.7–2.0	3.1	1.7–5.2	1.4	0.8–2.4
		Greenland	11	2.7	3.5	0.3	0.7	0.4–1.3	1.8	0.9–3.3	0.8	0.4–1.5
		Canada	2	0.9	1.1	0.1	0.3	0.0–1.0	0.8	0.1–2.8	0.3	0.0–1.2
	1969–73	Circumpolar	5	2.4	2.7	0.2	0.9	0.3–2.1	2.7	0.9–6.2	1.1	0.3–2.5
		Alaska	5	7.2	8.2	0.6	2.7	0.9–6.2	8.1	2.6–18.9	3.3	1.1–7.7
		Greenland	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
		Canada	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
	1974–78	Circumpolar	5	2.2	2.7	0.2	0.6	0.2–1.4	1.9	0.6–4.4	0.8	0.3–1.9
		Alaska	3	3.9	5.2	0.4	1.1	0.2–3.1	3.3	0.7–9.7	1.4	0.3–4.2
		Greenland	1	1.0	1.0	0.1	0.3	0.0–1.5	0.8	0.0–4.5	0.4	0.0–2.0
		Canada	1	1.9	2.9	0.2	0.6	0.0–3.2	2.0	0.0–11.0	0.8	0.0–4.4
	1979–83	Circumpolar	6	2.4	3.4	0.3	0.7	0.2–1.4	1.5	0.6–3.4	0.8	0.3–1.7
		Alaska	2	2.4	2.5	0.2	0.6	0.1–2.3	1.5	0.2–5.4	0.8	0.1–2.7
		Greenland	4	3.9	5.3	0.4	1.0	0.3–2.5	2.3	0.6–5.8	1.1	0.3–2.9
		Canada	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
	1984–88	Circumpolar	11	4.0	4.7	0.3	1.0	0.5–1.8	2.3	1.2–4.2	1.0	0.5–1.9
		Alaska	4	4.1	4.6	0.3	1.0	0.3–2.7	2.4	0.6–6.2	1.1	0.3–2.8
		Greenland	6	5.6	6.1	0.5	1.2	0.5–2.7	2.9	1.1–6.3	1.3	0.5–2.8
		Canada	1	1.5	1.6	0.1	0.4	0.0–2.3	1.0	0.0–5.6	0.4	0.0–2.5

Table 5

Cancer in Circumpolar Inuit 1969–1988 by site (ICD 9). Total number of cases, crude-, age standardized (ASR world)- and cumulative (Cum 64) incidence rates by sex and region. Standardized incidence ratios (SIR) and 95% confidence interval (95% CI) compared with Connecticut, Denmark and Canada

170 Bone		Total No.	Crude rate	ASR world	Cum 64	Connecticut		Denmark		Canada	
						SIR	95% CI	SIR	95% CI	SIR	95% CI
Males	Circumpolar	9	0.9	1.1	0.1	0.9	0.4–1.7	1.0	0.5–1.9	0.8	0.4–1.5
	Alaska	5	1.5	2.2	0.2	1.5	0.5–3.4	1.7	0.5–3.9	1.3	0.4–3.0
	Greenland	3	0.7	0.6	0.0	0.7	0.1–2.1	0.8	0.2–2.3	0.6	0.1–1.9
	Canada	1	0.4	0.3	0.0	0.4	0.0–2.5	0.5	0.0–2.8	0.4	0.0–2.2
Females	Circumpolar	6	0.6	0.7	0.1	1.0	0.4–2.2	1.2	0.4–2.5	0.7	0.3–1.6
	Alaska	4	1.2	1.2	0.1	2.0	0.5–5.0	2.2	0.6–5.7	1.4	0.4–3.7
	Greenland	1	0.2	0.2	0.0	0.4	0.0–2.2	0.5	0.0–2.5	0.3	0.0–1.6
	Canada	1	0.4	0.9	0.1	0.7	0.0–4.1	0.9	0.0–4.8	0.5	0.0–3.1

Table 6

Cancer in Circumpolar Inuit 1969–1988. Total number of cases and average annual incidence per 100 000 by site (ICD 9), sex and 5-year age group

		Age group																
		No.	00–04	05–09	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+
172 Melanoma of skin	Males	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0
	Females	6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	3.9	10.7	0.0	0.0	16.1
173 Skin (excl. melanoma of skin)	Males	20	0.0	0.0	0.0	0.0	2.1	0.0	0.0	1.9	0.0	5.1	6.3	7.7	0.0	19.4	43.9	46.4
	Females	15	0.0	0.0	0.0	0.0	1.1	0.0	0.0	2.0	0.0	0.0	6.4	7.8	0.0	25.9	38.6	8.0
191, 192 Brain and CNS ¹	Males	28	2.3	6.1	2.3	0.0	1.1	1.3	1.6	1.9	4.4	2.6	9.4	7.7	0.0	6.5	0.0	11.6
	Females	36	3.2	4.0	1.6	4.4	1.1	1.3	4.9	0.0	6.9	5.4	6.4	11.7	10.7	12.9	9.6	0.0
193 Thyroid	Males	7	0.0	0.0	0.0	0.0	1.1	0.0	4.8	0.0	0.0	0.0	0.0	3.8	5.6	0.0	0.0	11.6
	Females	27	0.0	0.0	0.0	0.9	1.1	2.7	9.9	7.9	9.2	5.4	3.2	7.8	5.3	0.0	9.6	16.1
170 Bone	Males	9	0.8	0.8	0.0	0.9	1.1	1.3	0.0	1.9	2.2	0.0	0.0	0.0	11.2	0.0	0.0	0.0
	Females	6	0.0	1.6	0.0	0.9	0.0	1.3	0.0	0.0	0.0	0.0	0.0	7.8	0.0	0.0	0.0	0.0
171 Connective tissue	Males	7	0.8	0.0	0.8	0.0	1.1	0.0	1.6	1.9	0.0	0.0	0.0	3.8	0.0	0.0	11.0	0.0
	Females	10	0.0	0.8	0.0	0.0	0.0	0.0	1.6	3.9	2.3	2.7	3.2	0.0	0.0	0.0	28.9	0.0
190 Eye	Males	3	0.8	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0	3.8	0.0	0.0	0.0	0.0
	Females	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unspecified and secondary tumors	Males	122	0.0	0.0	0.0	1.7	1.1	2.6	0.0	5.7	13.3	18.0	34.5	38.3	117.5	116.6	197.4	266.7
	Females	128	0.0	0.0	0.8	0.0	2.1	2.7	1.6	3.9	13.9	16.1	25.5	62.4	53.4	122.8	183.3	289.4
Other sites	Males	26	1.5	0.0	0.0	0.0	3.2	0.0	0.0	3.8	4.4	7.7	6.3	0.0	16.8	19.4	32.9	34.8
	Females	43	0.8	0.0	0.0	0.0	2.1	1.3	4.9	0.0	0.0	2.7	15.9	19.5	16.0	38.8	48.2	88.4

¹Benign brain tumours are included in the Greenlandic data

Table 7

Cancer in Circumpolar Inuit 1969–1988 by site (ICD 9). Total number of cases, crude-, age standardized (ASR world)- and cumulative (Cum 64) incidence rates by sex and region. Standardized incidence ratios (SIR) and 95% confidence interval (95% CI) compared with Connecticut, Denmark and Canada

171 Connective tissue		Total No.	Crude rate	ASR world	Cum 64	Connecticut		Denmark		Canada	
						SIR	95% CI	SIR	95% CI	SIR	95% CI
Males	Circumpolar	7	0.7	0.8	0.0	0.4	0.2–0.8	0.9	0.3–1.8	0.4	0.2–0.9
	Alaska	4	1.2	1.2	0.1	0.6	0.2–1.7	1.4	0.4–3.5	0.7	0.2–1.7
	Greenland	1	0.2	0.2	0.0	0.1	0.0–0.7	0.3	0.0–1.6	0.1	0.0–0.8
	Canada	2	0.9	1.5	0.0	0.5	0.1–1.9	1.1	0.1–4.1	0.5	0.1–2.0
Females	Circumpolar	10	1.0	1.5	0.1	0.8	0.4–1.4	1.6	0.8–3.0	0.7	0.4–1.4
	Alaska	4	1.2	2.3	0.1	0.9	0.2–2.2	1.9	0.5–5.0	0.9	0.2–2.2
	Greenland	3	0.7	0.8	0.1	0.5	0.1–1.5	1.1	0.2–3.2	0.5	0.1–1.5
	Canada	3	1.3	2.0	0.1	1.0	0.2–3.0	2.4	0.5–7.1	1.1	0.2–3.1

Table 8

Cancer in Circumpolar Inuit 1969–1988 by Site (ICD 9). Total number of cases, crude-, age standardized (ASR world)- and cumulative (Cum 64) incidence rates by region. Standardized incidence ratios (SIR) and 95% confidence interval (95% CI) compared with Connecticut, Denmark and Canada. Males

190 Eye	Total No.	Crude rate	ASR world	Cum 64	Connecticut		Denmark		Canada	
					SIR	95% CI	SIR	95% CI	SIR	95% CI
Circumpolar	3	0.3	0.4	0.0	0.7	0.1–2.0	0.4	0.1–1.2	0.5	0.1–1.4
Alaska	2	0.6	0.7	0.1	1.2	0.1–4.4	0.8	0.1–2.7	0.9	0.1–3.3
Greenland	1	0.2	0.2	0.0	0.5	0.0–3.0	0.3	0.0–1.8	0.4	0.0–2.2
Canada	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–

Table 9

Cancer in Circumpolar Inuit 1969–1988 by site (ICD 9). Total number of cases, crude-, age standardized (ASR world)- and cumulative (Cum 64) incidence rates by sex, region and 5-year time period. Standardized incidence ratios (SIR) and 95% confidence interval (95% CI) compared with Connecticut, Denmark and Canada

	Unspecified and secondary tumours	Total No.	Crude rate	ASR world	Cum 64	Connecticut		Denmark		Canada		
						SIR	95% CI	SIR	95% CI	SIR	95% CI	
Males	1969–88	Circumpolar	122	12.4	23.4	1.2	1.9	1.6–2.2	2.8	2.3–3.4	2.8	2.3–3.3
		Alaska	37	11.0	18.4	0.9	1.5	1.0–2.0	2.2	1.5–3.0	2.2	1.5–3.0
		Greenland	70	16.8	32.4	1.5	2.6	2.0–3.2	3.9	3.0–4.9	3.8	3.0–4.8
		Canada	15	6.4	13.7	0.9	1.2	0.7–2.0	1.8	1.0–2.9	1.8	1.0–2.9
	1969–73	Circumpolar	24	11.2	25.5	0.9	1.5	1.0–2.2	4.5	2.9–6.6	3.9	2.5–5.9
		Alaska	8	11.3	21.1	0.7	1.3	0.6–2.6	3.9	1.7–7.7	3.5	1.5–6.9
		Greenland	12	12.3	29.5	1.2	1.7	0.9–3.0	5.2	2.7–9.1	4.6	2.4–8.0
		Canada	4	8.6	22.6	0.5	1.3	0.3–3.3	3.8	1.0–9.8	3.4	0.9–8.7
	1974–78	Circumpolar	28	11.8	24.0	1.3	1.7	1.1–2.4	3.4	2.3–4.9	2.9	2.0–4.2
		Alaska	7	8.9	14.8	1.0	1.1	0.4–2.2	2.2	0.9–4.6	1.9	0.8–4.0
		Greenland	19	18.6	39.9	1.6	2.6	1.6–4.1	5.5	3.3–8.5	4.7	2.8–7.4
		Canada	2	3.6	8.3	1.0	0.6	0.1–2.2	1.3	0.1–4.5	1.1	0.1–3.9
	1979–83	Circumpolar	36	14.1	25.2	1.3	2.3	1.6–3.1	2.7	1.9–3.7	2.7	1.9–3.7
		Alaska	14	16.1	26.5	1.4	2.2	1.2–3.7	2.6	1.4–4.4	2.6	1.4–4.4
		Greenland	19	18.0	31.7	1.7	2.9	1.7–4.5	3.4	2.0–5.3	3.4	2.0–5.2
		Canada	3	4.7	6.3	0.6	1.0	0.2–3.0	1.2	0.2–3.4	1.2	0.2–3.5
	1984–88	Circumpolar	34	12.1	20.4	1.1	2.1	1.4–2.9	2.1	1.5–2.9	2.3	1.6–3.3
		Alaska	8	8.1	12.5	0.5	1.2	0.5–2.4	1.3	0.5–2.5	1.4	0.6–2.7
		Greenland	20	17.8	29.2	1.5	3.0	1.8–4.7	3.0	1.8–4.7	3.4	2.1–5.2
		Canada	6	8.7	18.7	1.3	1.9	0.7–4.1	1.9	0.7–4.1	2.1	0.8–4.6
Females	1969–88	Circumpolar	128	13.3	21.6	0.9	2.3	1.9–2.7	3.1	2.6–3.7	3.5	2.9–4.1
		Alaska	45	13.7	20.6	1.0	2.3	1.7–3.1	3.1	2.3–4.1	3.5	2.5–4.7
		Greenland	63	15.5	22.4	0.9	2.3	1.8–3.0	3.2	2.5–4.1	3.6	2.7–4.6
		Canada	20	8.9	19.5	0.7	2.1	1.3–3.2	2.7	1.7–4.2	3.1	1.9–4.8
	1969–73	Circumpolar	19	9.0	16.9	0.5	1.4	0.9–2.3	3.4	2.1–5.3	3.8	2.3–6.0
		Alaska	7	10.0	13.9	0.5	1.6	0.6–3.3	3.6	1.5–7.5	4.2	1.7–8.6
		Greenland	12	12.3	22.1	0.6	1.8	0.9–3.2	4.4	2.3–7.7	4.9	2.5–8.5
		Canada	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
	1974–78	Circumpolar	32	14.0	24.6	0.9	2.1	1.5–3.0	3.9	2.7–5.5	4.2	2.8–5.9
		Alaska	15	19.5	33.3	1.2	2.9	1.6–4.8	5.3	3.0–8.7	5.8	3.2–9.5
		Greenland	13	13.0	19.6	0.9	1.8	0.9–3.1	3.3	1.8–5.6	3.5	1.8–5.9
		Canada	4	7.6	20.1	0.4	1.6	0.4–4.0	2.8	0.7–7.1	3.0	0.8–7.6
	1979–83	Circumpolar	42	17.1	27.0	1.5	3.3	2.4–4.4	3.5	2.5–4.7	3.6	2.6–4.9
		Alaska	14	16.7	25.8	1.4	3.2	1.7–5.4	3.4	1.9–5.7	3.5	1.9–5.9
		Greenland	22	21.6	29.4	1.4	3.5	2.2–5.3	3.8	2.4–5.7	3.9	2.5–5.9
		Canada	6	9.9	20.5	1.6	2.8	1.0–6.0	2.9	1.0–6.2	3.0	1.1–6.6
	1984–88	Circumpolar	35	12.8	18.3	0.7	2.3	1.6–3.2	2.3	1.6–3.1	2.7	1.9–3.8
		Alaska	9	9.3	11.9	0.6	1.6	0.7–3.1	1.6	0.7–3.0	1.9	0.9–3.6
		Greenland	16	14.8	19.4	0.8	2.3	1.3–3.8	2.3	1.3–3.7	2.7	1.6–4.5
		Canada	10	14.9	31.0	0.8	3.7	1.8–6.8	3.5	1.7–6.4	4.3	2.1–7.9

sites of urinary system, endocrine glands, ill defined sites and tumours of unspecified nature.

For women the SIRs in comparison with the Canada and Denmark cancer registries approximate to 1.0, except for the Canadian Inuit. For men the SIRs approximated to 1.0. However, further exploration of these findings are not possible considering them as a group. Nevertheless, there is not the same concern about these cancers as compared

with the unspecified and secondary cancer group, as they cannot impact on the interpretation of the findings on other specified sites.

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.

Table 10

Cancer in Circumpolar Inuit 1969–1988. Total number of cases and verification of diagnosis (% of total) by site (ICD 9) and region

		Total No.	DCO ¹ %	HV ² %	OTH ³ %
170 Bone	Circumpolar	15	0	100	0
	Alaska	9	0	100	0
	Greenland	4	0	100	0
	Canada	2	0	100	0
171 Connective tissue	Circumpolar	17	0	100	0
	Alaska	8	0	100	0
	Greenland	4	0	100	0
	Canada	5	0	100	0
172 Melanoma of skin	Circumpolar	8	0	100	0
	Alaska	5	0	100	0
	Greenland	2	0	100	0
	Canada	1	0	100	0
173 Skin (excl. melanoma of skin)	Circumpolar	35	6	91	3
	Alaska	2	0	100	0
	Greenland	22	0	100	0
	Canada	11	18	73	9
190 Eye	Circumpolar	3	0	100	0
	Alaska	2	0	100	0
	Greenland	1	0	100	0
	Canada	0	0	0	0
191, 192 Brain and CNS ⁴	Circumpolar	64	5	80	16
	Alaska	15	0	80	20
	Greenland	36	6	75	19
	Canada	13	8	92	0
193 Thyroid	Circumpolar	34	3	94	3
	Alaska	16	0	100	0
	Greenland	15	7	93	0
	Canada	3	0	67	33
Unspecified and secondary tumors	Circumpolar	250	12	62	26
	Alaska	82	0	74	26
	Greenland	133	17	54	29
	Canada	35	23	63	14
Other sites	Circumpolar	69	13	67	20
	Alaska	20	0	80	20
	Greenland	31	19	65	16
	Canada	18	17	56	28

¹DCO = Death certificate only.²HV = Histologically verified.³OTH = Other.⁴Benign brain tumors are included in the Greenlandic data.

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Table 11

Cancer in Circumpolar Inuit 1969–1988 by site (ICD 9). Total number of cases, crude-, age standardized (ASR world)- and cumulative (Cum 64) incidence rates by sex, region and 5-year time period. Standardized incidence ratios (SIR) and 95% confidence interval (95% CI) compared with Connecticut, Denmark and Canada

Other sites ¹		Total No.	Crude rate	ASR world	Cum 64	Denmark		Canada		
						SIR	95% CI	SIR	95% CI	
Male	1969–88	Circumpolar	26	2.6	4.3	0.2	1.2	0.8–1.7	0.7	0.5–1.1
		Alaska	8	2.4	4.2	0.3	1.0	0.4–1.9	0.6	0.3–1.2
		Greenland	11	2.6	3.9	0.2	1.2	0.6–2.1	0.7	0.4–1.3
		Canada	7	3.0	6.0	0.1	1.5	0.6–3.2	0.9	0.4–1.9
	1969–73	Circumpolar	6	2.8	5.2	0.2	1.3	0.5–2.8	1.0	0.4–2.3
		Alaska	1	1.4	3.7	0.5	0.6	0.0–3.3	0.5	0.0–2.7
		Greenland	1	1.0	1.1	0.1	0.5	0.0–2.8	0.4	0.0–2.2
		Canada	4	8.6	18.5	0.2	4.4	1.2–11.2	3.5	0.9–8.9
	1974–78	Circumpolar	4	1.7	2.7	0.1	0.8	0.2–1.9	0.5	0.1–1.2
		Alaska	0	0.0	0.0	0.0	0.0	–	0.0	–
		Greenland	3	2.9	5.3	0.2	1.3	0.3–3.9	0.8	0.2–2.4
		Canada	1	1.8	1.7	0.1	0.9	0.0–5.3	0.6	0.0–3.2
	1979–83	Circumpolar	12	4.7	7.9	0.4	2.1	1.1–3.7	1.2	0.6–2.1
		Alaska	7	8.0	13.5	1.0	3.3	1.3–6.8	1.8	0.7–3.8
		Greenland	3	2.8	3.4	0.1	1.2	0.3–3.6	0.7	0.1–2.1
		Canada	2	3.2	10.7	0.0	1.7	0.2–6.3	1.0	0.1–3.5
	1984–88	Circumpolar	4	1.4	2.0	0.1	0.6	0.2–1.5	0.3	0.1–0.9
		Alaska	0	0.0	0.0	0.0	0.0	–	0.0	–
		Greenland	4	3.6	4.9	0.3	1.4	0.4–3.6	0.9	0.2–2.2
		Canada	0	0.0	0.0	0.0	0.0	–	0.0	–
Females	1969–88	Circumpolar	43	4.5	6.9	0.3	1.4	1.0–1.9	1.0	0.7–1.3
		Alaska	12	3.7	5.6	0.1	1.1	0.6–2.0	0.8	0.4–1.4
		Greenland	20	4.9	6.9	0.4	1.4	0.8–2.1	1.0	0.6–1.5
		Canada	11	4.9	10.0	0.5	2.0	1.0–3.5	1.4	0.7–2.4
	1969–73	Circumpolar	5	2.4	4.5	0.3	0.8	0.3–2.0	0.6	0.2–1.5
		Alaska	3	4.3	6.1	0.2	1.5	0.3–4.4	1.1	0.2–3.3
		Greenland	2	2.1	3.4	0.4	0.7	0.1–2.5	0.5	0.1–1.8
		Canada	0	0.0	0.0	0.0	0.0	–	0.0	–
	1974–78	Circumpolar	8	3.5	5.5	0.2	1.1	0.5–2.1	0.7	0.3–1.4
		Alaska	2	2.6	4.2	0.1	0.8	0.1–2.9	0.5	0.1–1.9
		Greenland	5	5.0	7.3	0.2	1.4	0.5–3.3	0.9	0.3–2.2
		Canada	1	1.9	3.9	0.5	0.8	0.0–4.2	0.5	0.0–2.7
	1979–83	Circumpolar	16	6.5	9.9	0.3	1.9	1.1–3.0	1.4	0.8–2.3
		Alaska	5	6.0	9.6	0.0	1.7	0.5–4.0	1.3	0.4–3.0
		Greenland	6	5.9	8.3	0.4	1.5	0.5–3.2	1.1	0.4–2.4
		Canada	5	8.2	15.8	0.5	3.2	1.0–7.6	2.3	0.7–5.3
	1984–88	Circumpolar	14	5.1	7.0	0.4	1.6	0.9–2.7	1.1	0.6–1.9
		Alaska	2	2.1	2.6	0.2	0.6	0.1–2.2	0.4	0.1–1.6
		Greenland	7	6.5	8.2	0.4	1.8	0.7–3.7	1.3	0.5–2.7
		Canada	5	7.4	14.3	0.8	2.9	0.9–6.9	2.1	0.7–4.8

¹No rates available for this category for Connecticut

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