

CANCER AMONG CIRCUMPOLAR INUIT 1969–1988

Introduction and methods

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Cancer incidence data for Circumpolar Inuit populations were developed and compiled from Greenland, Canada and Alaska from 1969 to 1988 to provide the largest possible base of data for documenting the unusual patterns of cancer previously reported for these populations. Cancer incidence and population data were transferred to the Danish Cancer Registry. Coded information from various ICD-classifications and codes for the basis of diagnosis were transformed to one format, enabling joint analysis. Standard descriptive analysis was carried out with presentation of number of cases, crude incidence rates (CR), age-standardized rates (world) (ASR), cumulative rates to age 64 years, and indirectly standardized ratios (SIR) to the populations of Connecticut (USA), Canada and Denmark. The resulting database can be used to support collaborative international research among the Inuit populations.

The value of presenting cancer incidence data from different parts of the world in a comprehensive and standard format has been clearly demonstrated by the series 'Cancer Incidence in Five Continents', published by the International Association of Cancer Registries and the International Agency for Research on Cancer, WHO, Lyon. Cancer data related to the Inuit populations of the north have never formed part of these publications, primarily because population-based data from the small, scattered Inuit populations were not available. Data from Greenland were previously published in two monographs (1, 2), with a description of the cancer registra-

tion system. Data on Canadian Inuit are now available after the development of a cancer registration system for the Inuit of Canada (3); data for Inuit of the central and western Arctic had been published previously (4, 5). Cancer incidence data from Alaska were available at the Center for Disease Control, Anchorage, following WHO standards and since 1984 in a format compatible with the National Cancer Institute, USA, Surveillance, Epidemiology and End Results (SEER) programme. Earlier data have previously been published (6–8).

The objectives of the present study on cancer among Circumpolar Inuit, were to compile systematically collected cancer incidence data and to present this to the scientific community in a comprehensive tabular format supported by graphical presentation. A further objective was to provide sufficient background information (9–11) to assist in the interpretation of the findings. The compilation of these data into a standard registry format is hoped to stimulate further research uses of the database, such as international case-control studies or the evaluation of cancer control intervention studies among the Inuit populations. The current paper documents the methods used to analyse the combined Circumpolar data set, as presented in site-specific papers of this volume of *Acta Onocologica* (12–20).

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Table 1

Inuit population 1969–1988 by region, period, age and sex

Period	Age	Circumpolar		Alaska		Greenland		Canada	
		Men	Women	Men	Women	Men	Women	Men	Women
1969–73	00 –	7 161	6 785	2 112	1 933	3 281	3 148	1 768	1 704
	05 –	7 603	7 283	2 469	2 289	3 472	3 387	1 662	1 607
	10 –	6 132	5 831	2 174	2 117	2 739	2 547	1 219	1 167
	15 –	4 021	4 269	1 504	1 757	1 735	1 716	782	796
	20 –	3 029	3 116	935	1 054	1 363	1 351	731	711
	25 –	2 706	2 747	874	894	1 309	1 301	523	552
	30 –	2 437	2 423	766	815	1 141	1 089	530	519
	35 –	2 204	2 148	610	640	1 060	1 024	534	484
	40 –	1 970	1 930	595	619	939	981	436	330
	45 –	1 503	1 345	588	434	607	670	308	241
	50 –	1 232	1 214	399	444	551	557	282	213
	55 –	1 081	1 052	451	373	426	516	204	163
	60 –	670	759	219	199	329	444	122	116
	65 –	659	573	304	139	248	328	107	106
	70 –	306	355	83	65	169	220	54	70
	75 +	280	432	122	209	100	164	58	59
	Total	42 992	42 262	14 205	13 981	19 469	19 443	9 318	8 838
1974–78	00 –	5 891	5 542	2 089	1 950	1 958	1 850	1 844	1 742
	05 –	6 921	6 544	2 231	2 080	2 978	2 810	1 712	1 654
	10 –	7 043	6 770	2 147	2 064	3 305	3 212	1 591	1 494
	15 –	5 726	5 614	1 918	1 987	2 589	2 405	1 219	1 222
	20 –	4 159	4 080	1 396	1 456	1 804	1 670	959	954
	25 –	3 243	3 145	1 191	1 171	1 404	1 290	648	684
	30 –	2 898	2 829	926	938	1 297	1 245	675	646
	35 –	2 343	2 311	738	748	1 109	1 040	496	523
	40 –	2 171	2 042	650	661	1 038	974	483	407
	45 –	1 936	1 840	631	558	901	931	404	351
	50 –	1 394	1 391	484	499	577	633	333	259
	55 –	1 210	1 125	478	406	502	514	230	205
	60 –	825	883	279	268	381	468	165	147
	65 –	733	744	321	237	273	391	139	116
	70 –	413	469	154	131	188	271	71	67
	75 +	386	529	174	212	151	231	61	86
	Total	47 291	45 859	15 807	15 366	20 455	19 935	11 029	10 558
1979–83	00 –	6 011	5 612	2 066	1 966	2 030	1 875	1 915	1 771
	05 –	5 467	5 172	1 992	1 870	1 714	1 605	1 761	1 697
	10 –	6 912	6 503	2 120	2 010	2 842	2 685	1 950	1 808
	15 –	7 040	6 811	2 332	2 216	3 066	2 962	1 642	1 633
	20 –	5 515	5 322	1 857	1 857	2 481	2 280	1 177	1 185
	25 –	4 068	3 886	1 508	1 447	1 792	1 632	768	807
	30 –	3 287	3 039	1 085	1 061	1 390	1 215	812	763
	35 –	2 585	2 612	866	855	1 259	1 202	460	555
	40 –	2 292	2 171	704	703	1 064	985	524	483
	45 –	2 139	2 067	674	681	970	927	495	459
	50 –	1 796	1 736	569	554	845	880	382	302
	55 –	1 270	1 273	504	439	514	592	252	242
	60 –	979	960	339	336	435	449	205	175
	65 –	818	861	337	335	314	401	167	125
	70 –	527	577	224	197	216	319	87	61
	75 +	469	652	226	214	187	331	56	107
	Total	51 177	49 255	17 403	16 741	21 119	20 340	12 655	12 174
1984–88	00 –	7 238	6 903	2 784	2 650	2 425	2 317	2 029	1 936
	05 –	6 101	5 854	2 372	2 311	1 904	1 769	1 825	1 774
	10 –	5 568	5 247	2 159	2 057	1 668	1 558	1 741	1 632
	15 –	6 588	6 270	2 106	2 038	2 720	2 560	1 762	1 672
	20 –	6 293	6 204	1 878	1 850	2 946	2 901	1 469	1 453
	25 –	5 355	5 094	1 834	1 758	2 466	2 231	1 055	1 105
	30 –	4 002	3 845	1 428	1 471	1 805	1 632	769	742
	35 –	3 313	3 119	1 180	1 171	1 389	1 199	744	749
	40 –	2 592	2 507	877	862	1 232	1 139	483	506
	45 –	2 210	2 223	757	773	1 005	949	448	501
	50 –	1 965	1 942	599	596	898	881	468	465
	55 –	1 666	1 679	556	549	769	809	341	321
	60 –	1 101	1 146	409	420	456	529	236	197
	65 –	876	916	366	375	351	397	159	144
	70 –	578	672	228	228	228	317	122	127
	75 +	590	874	292	344	205	398	93	132
	Total	56 037	54 495	19 825	19 453	22 467	21 586	13 745	13 456

Table 2

Cancer in Circumpolar Inuit 1969–1988. Sources of mean population by region and time period

Period	Alaska	Canada	Greenland
1969–73	1970 Census	1971 Census; other sources	Population by 1 Jan. 1971
1974–78	Average of 1970 and 1980 Census	Average of 1971 and 1981 Census; other sources	Population by 1 Jan. 1976
1979–83	1980 Census	1981 Census; other sources	Population by 1 Jan. 1981
1984–88	Average of 1980 and 1990 Census	1986 Census; other sources	Population by 1 Jan. 1986

Methods

The minimum data set obtained from each of the involved areas contained incidence data on cancer cases diagnosed from 1969 to 1988, and included the following variables: sex, age at diagnosis, year of diagnosis, site and classification, morphology (if readily available), region of residence, and basis of diagnosis. Population figures for the relevant populations, and incidence rates for the comparison populations of Canada, Connecticut (USA) and Denmark were also obtained. Data on 40 cancer cases provided from Russian Inuit could not be included in the joint analyses as the necessary population data for Soviet Inuit were not available; however, they are reported separately (21).

Data and time periods

Incidence data for Inuit populations in Canada, Alaska and Greenland for the publication were submitted to the Danish Cancer Registry in a standard format of anonymized single tumour records by sex, year of diagnosis, and age at diagnosis. Use of these data was restricted to this project only. Any other use of the combined database must be approved by the original data providers which are the Alaska Native Cancer Surveillance System, the National Cancer Incidence Reporting System at Statistics Canada, and the Danish Cancer Registry.

Data were requested for time periods where cancer registration was believed to be adequate and of high quality, and thus the current project covers the 20 years 1969–1988. To obtain reasonably stable figures, data are presented in aggregate 5-year calendar periods: 1969–1973, 1974–1978, 1979–1983, and 1984–1988.

Populations

Circumpolar and regional Inuit populations for Alaska, Canada and Greenland are listed in Table 1 by 5-year time period, 5-year age group (up to 75+) and sex. Mean populations for each 5-year time period are based on census data in Alaska (census years: 1970, 1980, 1990) and Canada (census years: 1971, 1981, 1986 supplemented by other sources), whereas in Greenland population statistics

are available annually from the computerized Danish Central Population Registry (Table 2).

Classification

The codes used in Alaska (ICD-O-2), Canada (ICD 9), and Greenland (modified version of ICD 7 (22)) were converted into a common format, comprising 42 sites (Table 3). Greenlandic data include papilloma of the bladder and benign neoplasms of the brain and central nervous system, whereas these are excluded from Alaska and Connecticut data.

In Canada, some temporal and regional variation occurred with respect to reporting bladder papillomas, which would have a small effect on the denominators in the study; benign brain neoplasms were not reportable during the period 1969–1988. Data for ICD9 173, non-melanoma skin cancer, are incompletely reported for Canada (Statistics Canada) and are not reported by Connecticut.

Basis of diagnosis

Each of the three countries has devised its own code for the most valid basis of diagnosis. These were translated (Table 4) into three categories: histologically verified (HV), death certificate only (DCO), and other (OTH), and tabulated by site and country. Basis of diagnosis was then presented for the entire study period by site, country, and the combined Circumpolar area. The data, however, were also inspected by the authors by calendar period, to evaluate any change in basis of diagnosis over time.

Computation of standardized incidence ratio (SIR), age-adjusted rate and cumulative rate

Total number of cancer cases and incidence rates by site, time-period and sex were calculated for the combined Circumpolar Inuit population and for the Inuit populations in Alaska, Canada, and Greenland. Age-specific rates (up to age 75+) were calculated for the combined 20-year period. Although ideally age-specific rates should be used to compare cancer incidence among Inuit and other popu-

Table 3

Cancer in Circumpolar Inuit 1969–1988. Grouping of sites and corresponding ICD 9 codes

Site	ICD 9
Lip	140
Tongue	141
Salivary glands	142
Mouth	143, 144, 145
Oropharynx	146
Nasopharynx	147
Hypopharynx	148
Pharynx, unspecified	149
Oesophagus	150
Stomach	151
Small intestine	152
Colon	153
Rectum including rectosigmoid junction	154
Liver	155
Gall bladder and extrahepatic bile ducts	156
Pancreas	157
Nasal cavities and paranasal sinuses	160
Larynx	161
Lung	162
Breast	174
Cervix uteri	180
Corpus uteri	182
Placenta*	181
Ovary and other uterine adnexa	183
Prostate	185
Testis	186
Penis	187
Kidney including renal pelvis and ureter	189
Bladder	188
Non-Hodgkin lymphoma	200, 202
Hodgkin's disease	201
Leukaemia	204, 205, 206, 207, 208
Multiple myeloma	203
Melanoma of skin	172
Skin (excluding melanoma of skin)	173
Brain and CNS	191, 192
Thyroid	193
Bone	170
Connective tissue	171
Eye	190
Unspecified and secondary tumours	196–199
Other sites	158, 159, 163, 164, 165, 179, 184, 189.3, 189.9, 194, 195, 239.

* only 6 cases total and not presented in tables.

lations, this process is cumbersome. Several summary statistics (SIR, age-adjusted rates and cumulative rates) were therefore used to facilitate such comparisons.

Standardized incidence ratios were obtained by dividing the observed number of cases with the number expected if the study population had the same cancer incidence as that of a given reference population. Expected cases were calculated using age–sex–site–period specific cancer incidence

rates for the total Canadian population (supplied by Statistics Canada from the National Cancer Incidence Reporting System), for the total Danish population in Denmark (supplied by the Danish Cancer Registry) and for the white population in Connecticut. Incidence rates for Connecticut were taken from the person-years at risk software (O/E program) of the National Cancer Institute in the United States, which did not include unspecified pharynx, liver, gall bladder, biliary tract and penis. Age- and sex-specific rates for these sites were obtained from Cancer Incidence in Five Continents, volume III, IV, V and VI, in the periods 1968–1972, 1973–1977, 1978–1982, 1983–1987 (23–26). Rates for unspecified pharynx were only available for 1978–1982 and 1983–1987. Since only one case occurred the site was omitted for Connecticut. In general the comparison with a country (SIR) was left blank if rates were not available.

Confidence intervals were calculated assuming a Poisson distribution (27).

Age-adjusted incidence rates were computed using the world population (28). The method used is referred to as direct standardization, which applies the age-specific incidence rates to that of a hypothetical population. The 'world' population gives relatively high weight to young populations, such as Inuit, and lower weights to older populations, such as the three comparison populations.

Cumulative rates (29) have been defined as a sum over each year of age of the age-specific incidence rates up to a stated age. In the project of cancer among Circumpolar Inuit such rates were calculated up to and including the age of 64 years. The cumulative rates are given in percentage.

Sex ratios were calculated as the ratio of male:female age-standardized rates.

Graphics

Age-adjusted period- and site-specific incidence rates were plotted for each country and for all Inuit populations combined. Due to small numbers, rates are very unstable and only presented where a Circumpolar trend is based on a sufficiently large number of cases. The international variation was plotted taking age-standardized incidence rates from Cancer Incidence in Five Continents, volume VI (26)—years 1983–1987—and data from the current analysis 1984–1988 on Inuit.

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

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Table 4

Cancer in Circumpolar Inuit 1969–1988. Basis of diagnosis used nationally and corresponding category used in this study

Basis of diagnosis	Alaska	Canada	Greenland	Category used in this study
Histology	X	X	X	HV
Histology of metastasis	–	–	X	HV
Autopsy with histology	–	X	X	HV
Cytology	X	X	X	HV
Cytology/haematology	–	–	X	HV
Surgery/autopsy without histology	–	–	X	OTH
Direct observation	X	–	–	OTH
Radiology	X	X	X	OTH
Clinical dx. only	X	X	X	OTH
Death certificate	–	X	X	DCO
Unknown	X	X	X	OTH

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