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CANCER OF THE MALE GENITAL TRACT IN CIRCUMPOLAR INUIT

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In an international collaboration project we combined cancers of the male genital tract among Inuit identified from routine cancer registry systems in the Circumpolar region (Alaska, Canada and Greenland) and compared incidence rates with rates in Denmark, Connecticut (USA) and Canadian non-Inuit. We observed a low risk of prostate cancer (standardized incidence ratio (SIR) 0.2–0.3) and the incidence rate of 7.8 per 100 000 (world standard) is among the lowest in the world. Dietary and not diagnostic factors are likely explanations of this finding. Testicular cancer also occurred with low rates (SIR 0.3–0.7) although only significantly so when compared with Denmark and Connecticut (USA) which have some of the world's highest incidence rates of this cancer. Penile cancer occurred with relatively high risk (SIR 1.8–3.0) based on rates among non-Inuit. The incidence is, however, lower than anticipated considering the possibility for shared risk factors with cancer of the uterine cervix.

Cancer of the male genital tract includes prostate, testicular and penile cancer. Both testicular cancer and penile cancer are relatively infrequent (1), whereas the incidence of prostate cancer is increasing worldwide and is one of the most frequent cancers in men in the western hemisphere (1). While both cancer of the prostate and of the penis are primarily diseases of older men, testicular cancer peaks in incidence among men aged 20–45 years (1). The Inuit differ from the chosen comparison populations not only in genetic background but also in environment and lifestyle factors, and the comparison of rates of male genital cancers may suggest potential risk factors for this group of cancers for which little is known about the etiology. The current paper is part of a joint project analyzing 20 years of cancer incidence data among the Circumpolar Inuit.

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Material and Methods

We collected cancer incidence data from 1969–1988 for the Inuit populations of Alaska, Canada and Greenland and compiled these into a standard format for the purpose of this analysis. Background information, definitions, methods and data sources are fully described previously (2–5). The accompanying site-specific tables give by calendar period and country, 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), for the comparison populations: Connecticut (USA), Denmark, and Canadian non-Inuit. 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.

Prostate (ICD-9 185)

Results. We identified 37 cases of cancer of the prostate in Circumpolar Inuit from 1969 to 1988, giving an ASR of 7.8 per 100 000 person-years (Table 1). Prostate cancer constituted 2.4% of all cancers (excluding other skin) in the period. Of the 26 cases reported for Alaska Inuit, 12 occurred in the 5-year period 1979–1983. ASR for this 5-year period was, thus, the highest for the entire 20-year

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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 region and 5-year time period. Standardized incidence ratios (SIR) and 95% confidence interval (95% CI) compared with Connecticut, Denmark and Canada

185 Prostate		Total No.	Crude rate	ASR world	Cum 64	Connecticut		Denmark		Canada	
						SIR	95% CI	SIR	95% CI	SIR	95% CI
1969–88	Circumpolar	37	3.7	7.8	0.1	0.2	0.1–0.2	0.3	0.2–0.4	0.2	0.1–0.2
	Alaska	26	7.7	12.9	0.2	0.3	0.2–0.4	0.5	0.3–0.7	0.3	0.2–0.4
	Greenland	4	1.0	1.7	0.1	0.0	0.0–0.1	0.1	0.0–0.2	0.0	0.0–0.1
	Canada	7	3.0	8.6	0.2	0.2	0.1–0.4	0.3	0.1–0.6	0.2	0.1–0.4
1969–73	Circumpolar	5	2.3	5.7	0.1	0.1	0.0–0.3	0.3	0.1–0.6	0.2	0.1–0.4
	Alaska	4	5.6	14.9	0.0	0.3	0.1–0.8	0.5	0.1–1.3	0.4	0.1–0.9
	Greenland	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
	Canada	1	2.1	3.9	0.5	0.2	0.0–0.9	0.3	0.0–1.5	0.2	0.0–1.1
1974–78	Circumpolar	4	1.7	3.8	0.1	0.1	0.0–0.2	0.1	0.0–0.4	0.1	0.0–0.2
	Alaska	2	2.5	4.6	0.0	0.1	0.0–0.4	0.2	0.0–0.6	0.1	0.0–0.4
	Greenland	1	1.0	1.7	0.2	0.0	0.0–0.3	0.1	0.0–0.5	0.1	0.0–0.3
	Canada	1	1.8	6.6	0.0	0.1	0.0–0.6	0.2	0.0–1.1	0.1	0.0–0.7
1979–83	Circumpolar	15	5.9	11.7	0.2	0.2	0.1–0.4	0.4	0.2–0.7	0.3	0.1–0.4
	Alaska	12	13.8	20.9	0.4	0.5	0.2–0.8	0.7	0.4–1.3	0.5	0.2–0.8
	Greenland	2	1.9	3.7	0.0	0.1	0.0–0.3	0.1	0.0–0.5	0.1	0.0–0.3
	Canada	1	1.6	4.6	0.0	0.1	0.0–0.5	0.2	0.0–0.9	0.1	0.0–0.6
1984–88	Circumpolar	13	4.6	8.8	0.2	0.2	0.1–0.3	0.3	0.2–0.5	0.2	0.1–0.3
	Alaska	8	8.1	12.9	0.2	0.3	0.1–0.5	0.4	0.2–0.8	0.2	0.1–0.5
	Greenland	1	0.9	1.0	0.1	0.0	0.0–0.2	0.1	0.0–0.3	0.0	0.0–0.2
	Canada	4	5.8	15.8	0.4	0.3	0.1–0.8	0.5	0.1–1.2	0.3	0.1–0.7

period of observation with 20.9 per 100 000 for Alaska and 11.7 for the Circumpolar region. With a total number of cases of 4, we observed the lowest incidence rate for all 5-year periods and for the entire period 1969–1988 for Greenland with incidence rates between 0 and 3.7 per 100 000. Compared with the populations of Connecticut (USA), Denmark and Canadian non-Inuit, prostate cancer incidence among Inuit was significantly low with SIRs ranging from 0.2 to 0.3.

All 37 cancers were diagnosed in men 50 years of age or older and an increasing frequency with increasing age was observed (Table 2). Six of the 7 prostate cancers diagnosed in Canada were histologically verified (Table 3), as were 25 of 26 in Alaska and 3 of 4 in Greenland. Twenty-eight cases were adenocarcinomas.

Discussion. The incidence of prostate cancer was low for all three Inuit populations compared with the populations of Denmark, Connecticut (USA) and Canadian non-Inuit. Incidence rates are equivalent to those observed for low-risk populations in Asia and are very low compared with the high-risk black population in the USA (1, 6). The age-distribution did not differ from other populations.

The incidence of prostate cancer is influenced by the number of latent cancers (i.e., without clinical symptoms) diagnosed, and thus by the degree of medical surveillance, including transurethral resections for prostatic hypertrophy, use of prostate-specific antigen (PSA) and of the autopsy rate. The low autopsy rates in Greenland (7) and in the Northwest Territories of Canada (Gaudette: Pers. comm.) partly explain the low incidence of prostate cancer among Inuit.

Incidence rates for prostate cancer have increased steadily in the comparison populations throughout the time period observed. Part of the increase may be attributable to increased use of diagnostic procedures, which detect latent cancers. However, in Denmark, PSA is not

Table 2

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

		Age groups															
	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+
185 Prostate	37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	15.3	11.2	45.4	76.8	185.5
186 Testis	21	0.8	0.0	0.0	0.9	0.0	10.4	1.6	3.8	6.6	5.1	3.1	3.8	0.0	6.5	0.0	0.0
187 Penis	10	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0	3.1	3.8	0.0	0.0	43.9	11.6

Table 3

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

		Total No.	DCO[1] %	HV[2] %	OTH[3] %
185 Prostate	Circumpolar	37	5	89	5
	Alaska	26	0	96	4
	Greenland	4	0	75	25
	Canada	7	29	71	0
186 Testis	Circumpolar	21	5	95	0
	Alaska	6	0	100	0
	Greenland	9	0	100	0
	Canada	6	17	83	0
187 Penis	Circumpolar	10	0	100	0
	Alaska	4	0	100	0
	Greenland	6	0	100	0
	Canada	0	0	0	0

[1] DCO = Death certificate only.
[2] HV = Histologically verified.
[3] OTH = Other.

widely used and diagnostic activities for prostate cancer are the least aggressive in the Nordic countries (Tretle: Pers. comm.). In the Northwest Territories the overall low rates are due to low rates in the Inuit population, whereas non-native of the same area exhibited rates similar to the remainder of Canada (8). This verifies that diagnostic procedures are generally available in the north, and the low risk of prostate cancer in Inuit is likely to be due to differences in prevalence of risk factors.

Prostate cancer is significantly more frequent in male relatives of prostate cancer patients than of controls and high risks of prostate cancer have been reported in blacks all over the world, suggesting a possible independent genetic component to the disease (9). This may also explain the comparable rates between the Asian populations and the Inuit. However, migrant studies of Asians to the USA have found that the incidence of prostate cancer increases already in the first generation and environmental factors

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 region and 5-year time period. Standardized incidence ratios (SIR) and 95% confidence interval (95% CI) compared with Connecticut, Denmark and Canada

186 Testis		Total No.	Crude rate	ASR world	Cum 64	Connecticut		Denmark		Canada	
						SIR	95% CI	SIR	95% CI	SIR	95% CI
1969–88	Circumpolar	21	2.1	2.5	0.2	0.6	0.3–0.9	0.3	0.2–0.5	0.7	0.4–1.1
	Alaska	6	1.8	2.1	0.2	0.5	0.2–1.0	0.3	0.1–0.6	0.6	0.2–1.3
	Greenland	9	2.2	2.3	0.2	0.5	0.2–1.0	0.3	0.1–0.5	0.7	0.3–1.3
	Canada	6	2.6	3.7	0.2	0.7	0.3–1.6	0.4	0.1–0.9	1.0	0.3–2.1
1969–73	Circumpolar	6	2.8	4.0	0.2	1.2	0.5–2.7	0.6	0.2–1.2	1.4	0.5–3.0
	Alaska	1	1.4	1.8	0.1	0.6	0.0–3.5	0.3	0.0–1.6	0.7	0.0–4.0
	Greenland	4	4.1	5.6	0.4	1.8	0.5–4.6	0.8	0.2–2.1	2.0	0.5–5.2
	Canada	1	2.1	5.6	0.0	1.0	0.0–5.3	0.4	0.0–2.4	1.1	0.0–6.0
1974–78	Circumpolar	6	2.5	3.2	0.3	0.8	0.3–1.8	0.4	0.1–0.8	1.0	0.4–2.2
	Alaska	3	3.8	5.1	0.4	1.2	0.2–3.5	0.6	0.1–1.7	1.5	0.3–4.4
	Greenland	1	1.0	1.1	0.1	0.3	0.0–1.7	0.1	0.0–0.8	0.4	0.0–2.1
	Canada	2	3.6	4.3	0.4	1.2	0.1–4.5	0.6	0.1–2.1	1.6	0.2–5.6
1979–83	Circumpolar	5	2.0	2.0	0.1	0.4	0.1–1.0	0.3	0.1–0.6	0.6	0.2–1.4
	Alaska	1	1.1	1.1	0.1	0.3	0.0–1.4	0.2	0.0–0.8	0.4	0.0–2.0
	Greenland	3	2.8	3.0	0.2	0.6	0.1–1.7	0.3	0.1–1.0	0.8	0.2–2.4
	Canada	1	1.6	1.1	0.1	0.4	0.0–2.2	0.2	0.0–1.3	0.6	0.0–3.2
1984–88	Circumpolar	4	1.4	1.4	0.1	0.3	0.1–0.7	0.2	0.0–0.4	0.4	0.1–0.9
	Alaska	1	1.0	0.9	0.1	0.2	0.0–1.2	0.1	0.0–0.7	0.3	0.0–1.5
	Greenland	1	0.9	0.6	0.0	0.2	0.0–0.9	0.1	0.0–0.5	0.2	0.0–1.1
	Canada	2	2.9	3.9	0.4	0.7	0.1–2.5	0.4	0.0–1.3	0.9	0.1–3.1

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 region and 5-year time period. Standardized incidence ratios (SIR) and 95% confidence interval (95% CI) compared with Connecticut, Denmark and Canada

187 Penis		Total No.	Crude rate	ASR world	Cum 64	Connecticut		Denmark		Canada	
						SIR	95% CI	SIR	95% CI	SIR	95% CI
1969–88	Circumpolar	10	1.0	1.8	0.1	3.0	1.4–5.4	1.8	0.9–3.3	2.6	1.3–4.8
	Alaska	4	1.2	1.7	0.1	3.1	0.8–7.9	1.9	0.5–4.8	2.7	0.7–7.0
	Greenland	6	1.4	2.8	0.1	4.2	1.5–9.2	2.5	0.9–5.5	3.7	1.4–8.1
	Canada	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
1969–73	Circumpolar	4	1.9	3.5	0.1	10.0	2.7–25.7	3.7	1.0–9.4	5.3	1.4–13.7
	Alaska	2	2.8	5.6	0.0	13.6	1.5–49.0	5.0	0.6–18.0	7.2	0.8–26.0
	Greenland	2	2.1	3.6	0.1	11.6	1.3–41.7	4.2	0.5–15.2	6.2	0.7–22.3
	Canada	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
1974–78	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	–
1979–83	Circumpolar	2	0.8	1.6	0.0	1.9	0.2–6.8	1.3	0.1–4.6	2.1	0.2–7.6
	Alaska	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
	Greenland	2	1.9	4.0	0.0	4.4	0.5–15.9	3.0	0.3–10.8	4.9	0.6–17.8
	Canada	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–
1984–88	Circumpolar	4	1.4	2.1	0.1	3.5	0.9–8.9	2.3	0.6–5.9	3.4	0.9–8.7
	Alaska	2	2.0	3.0	0.3	4.5	0.5–16.1	3.0	0.3–10.7	4.4	0.5–16.0
	Greenland	2	1.8	2.8	0.1	4.2	0.5–15.2	2.8	0.3–10.0	4.1	0.5–14.7
	Canada	0	0.0	0.0	0.0	0.0	–	0.0	–	0.0	–

must thus be of importance in the pathogenesis. Dietary factors, in particular a diet high in animal fat, are so far the most consistent risk-enhancing factors observed (9). This tallies with the observed low incidence of prostate cancer among Inuit, whose diet includes less animal fat than that of non-Inuit populations (10)—perhaps with the exception of the Alaskan Inuit, who appear to be more urbanized (4) an in whom the rates are also higher. Current data suggest that diet determines the risk of prostate cancer through its influence on sex hormone metabolism. A number of other factors that may be indicators of sex hormone levels have been reported to be associated with risk of prostate cancer. These include sexually transmitted infections, sexual activity, and marital status. However, these observations have not been consistent across studies (9).

Testis (ICD-9 186)

Results. In the period 1969–1988, testicular cancer constituted 1.4% of the total number of cancers (excluding other skin) in Circumpolar Inuit men. The total number of testicular cancers was 21, with 6 in Alaska, 9 in Greenland and 6 in Canada (Table 4). Compared with the incidence in Denmark, Connecticut (USA), and Canadian non-Inuit the incidence in Inuit was lower (SIR 0.3–0.7). The ASR for the Circumpolar region for the entire period was 2.5 per 100 000 person-years. ASRs decreased over time from 4.0 in 1969–1973 to 1.4 in 1984–1988. The highest incidence for a subpopulation of Inuit was observed for Greenland (5.6 per 100 000) based on four cases in the period 1969–1973. Due to the small numbers it is impossible to evaluate incidence trends for regional Inuit populations.

The age distribution showed a small peak in infancy, followed by peak incidence in the age-group 25–39 years and a smaller peak after 65 years of age (Table 2). The peak in infancy was only present in Alaskan Inuit while the peak after 65 was pronounced only in Inuit in Canada. All cases of testicular cancer were histologically verified, except for one case diagnosed in Canada in the period 1969–1973 (death certificate) (Table 3). One case of malignant teratoma was diagnosed in a 25-year-old man from Alaska, one case of an endodermal sinus tumour was diagnosed in a 3-year-old boy also from Alaska and one case from Canada proved to be carcinoma (not otherwise specified), while the remaining 18 histologically verified cancers all were seminomas.

Discussion. The incidence of testicular cancer in Inuit is low compared with the incidence in the populations of Denmark, Connecticut (USA) and Canadian non-Inuit. The incidence of testicular cancer in the populations of Denmark and Connecticut (USA) is, however, among the highest in the world (1, 11). The incidence of testicular cancer in Inuit is comparable with the incidence in low-risk populations of Asia and Japan (1), while the incidence in Inuit is low compared with most other populations in the world. The age distribution did not differ from other populations.

The testes are easily available for examination and differences in diagnostic facilities should therefore have little effect on the diagnosis of testicular cancer. Missed cases of testicular cancer in Inuit are, thus, not a likely explanation for the significantly decreased risks observed. A genetic component in the etiology of testicular cancer cannot be excluded and the difference in incidence of testicular cancer observed between the Inuit and the populations of Denmark and Connecticut (USA) may be due to different genetic backgrounds. The difference may, however, also be due to differences in prevalence of or exposure to suspected risk factors for testicular cancer, such as cryptorchidism (12), and environmental oestrogens (13, 14).

Penis (ICD-9 187)

Results. We observed only 10 cases of penile cancer among Circumpolar Inuit from 1969–1988; 4 in Alaskan Inuit, 6 in Greenland Inuit and none in Canadian Inuit (Table 5). Penile cancer, thus, constituted only 0.7% of the total number of cancers (excluding other skin) in Inuit men. The ASR for the period 1969–1988 was 1.8 per 100 000 for the Circumpolar Inuit. We found the highest incidence rate among Alaskan Inuit in the period 1969–1973 and observed increased risks among the Inuit with SIRs in 1969–73 of 3.7 (Denmark), 5.3 (Canadian non-Inuit) and 10.0 (Connecticut, USA). No cases of penile cancer were diagnosed in the period 1974–1978 and the incidence in the following two 5-year periods did not differ significantly from the incidence in Denmark, Canadian non-Inuit or Connecticut (USA).

Four cases were diagnosed in patients younger than 55 years, while the remaining 6 cases occurred in men 55 years or older (Table 2). All cases were histologically verified (Table 3). Nine cases were squamous cell carcinomas, and one proved to be an embryonal rhabdomyosarcoma in a 5-year-old boy.

Discussion. With only 10 cases over a time period of 20 years, evaluation of the pattern of this disease among the Inuit is limited. The incidence in Inuit is comparable with those of European countries and is low compared with high-risk populations of Latin America, Asia and Africa (1).

The etiology of penile cancer is unknown but practices of circumcision and personal hygiene are viewed as potential effective preventive measures (15). Circumcision is, however, not common among Inuit. Based on findings of a higher risk of cervical cancer among wives of men with penile cancer it has been suggested that these two cancers share a common etiological factor, possibly infectious (16). Indeed the finding that HPV is prevalent in biopsies from penile cancers points in this direction (15). Marked differences in the epidemiology of cervical and penile cancer have, however, been reported (16); findings that contradict the hypothesis of a common etiology. The Inuit populations may be another example of these differences with the high incidence of cervical cancer and no clear indication of a high risk of cancer of the penis.

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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