

Cancer in Alaskan Indians, Eskimos, and Aleuts, 1969-83: Implications for Etiology and Control

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Synopsis

The authors collected and analyzed cancer incidence data for Alaska Natives (Indians, Eskimos, and Aleuts) for the 15-year period 1969-83 by ethnic and linguistic groups. Compared with U.S. whites, observed-to-expected ratios are high in more than one ethnic group for cancer of the nasopharynx, salivary gland, liver, gallbladder, and cervix. Low ratios were found for cancer of the breast, uterus, bladder, and melanoma.

In Alaska, Eskimos have the highest risk for cancer of the esophagus and liver and the lowest risk for breast and prostate cancer. Risk for multiple myeloma in Indian men in Alaska exceeds not only those of other Native groups in Alaska but that in U.S. whites as well. Despite the short period studied, increases in cancer incidence over time can be documented for lung cancer in Eskimo men and women combined, and for cervical cancer, especially in Indian women.

PREVIOUS REPORTS OF CANCER in Alaska Natives (Eskimos, Indians, and Aleuts) indicate that the overall incidence for cancer did not differ significantly from that of U.S. whites, while marked differences were found for specific cancer sites (1,2). In addition, examination of data for the periods 1969-73 and 1974-78 revealed differences between ethnic groups in Alaska in cancer incidence patterns (2,3). This paper includes incidence data for an additional period, 1979 to 1983, compares cancer frequencies in the three major groups of Alaska Natives—Indians, Eskimos, and Aleuts—and among linguistic subgroups, and examines trends over the 15-year period 1969 through 1983.

Materials and Methods

All Alaska Native patients with invasive cancer diagnosed from 1969 to 1983 who were residents of Alaska at the time of diagnosis have been registered in the Centers for Disease Control and Indian Health Service collaborative cancer surveillance project. Data before 1979 were collected in two 5-year retrospective surveys. From 1979 on, all cancer cases were identified as part of an ongoing surveillance project.

As described in earlier reports (1-3), cases were

identified by review of hospital discharge diagnoses, tumor registries, pathology reports, and death certificates. All patient records were reviewed, and information on age, sex, ethnicity, primary cancer site, histology, and basis of diagnosis was recorded. Cases were classified as identified from the death certificate only after extensive attempts to locate and review original hospital records and query attending physicians were unsuccessful or recovered no additional information.

Persons were considered to be Alaskan Native if they classified themselves Native and were eligible for care by the Alaska Area Native Health Service of the Indian Health Service (IHS). Classification as Indian, Eskimo, or Aleut is part of the IHS medical record and is based on self-designation. Coded classification was checked for accuracy by comparing the birthplace and residence of the patient and his or her parents with knowledge of the traditional geographic distribution of each ethnic group in Alaska. Residence at birth of the patient or his or her parents was used to assign each patient to a linguistic group (4).

Alaskan Indians include Athabascans, who occupy the interior, and Tlingit, Haida, and Tsimshian tribes, who reside mainly in the area of the State adjacent to British Columbia. Four Eskimo

Table 1. Observed number of cancer cases and observed-to-expected (O:E) ratio¹ by primary cancer site, Alaskan Indians, Eskimos, and Aleuts, 1969-83

Site	Indian men		Indian women		Eskimo men		Eskimo women		Aleut men		Aleut women	
	Observed	O:E	Observed	O:E	Observed	O:E	Observed	O:E	Observed	O:E	Observed	O:E
Total	271	0.9	246	0.9	388	² 0.9	341	0.9	95	0.9	124	³ 1.3
Salivary	1	1.1	4	² 5.1	3	2.2	5	² 4.4	0	0	0	0
Nasopharynx	6	³ 9.8	4	³ 13.8	19	³ 20.2	10	³ 22.7	8	³ 33.3	2	² 18.2
Other oral and pharynx	5	² 0.4	6	1.5	1	³ 0.1	5	0.9	1	0.2	4	2.8
Esophagus	5	1.4	1	0.8	11	² 2.0	6	² 3.5	2	1.6	0	0
Stomach	10	1.1	8	1.9	35	³ 2.6	7	1.2	6	1.9	1	0.8
Colon	31	1.1	25	1.0	46	1.2	56	³ 1.7	9	1.0	18	³ 2.3
Rectum	18	1.3	12	1.4	18	0.9	12	1.0	4	0.8	9	³ 3.1
Liver	4	2.0	1	1.0	26	³ 8.5	4	2.9	1	1.4	1	3.1
Gallbladder	4	2.2	9	³ 4.3	7	² 2.6	19	³ 6.6	1	1.6	1	1.5
Pancreas	6	0.7	3	0.5	16	1.2	9	1.1	2	0.7	9	³ 4.9
Other digestive	2	1.6	4	3.2	6	² 3.3	8	³ 4.5	0	0	0	0
Larynx	3	0.5	0	0	2	³ 0.2	0	0	1	0.4	0	0
Lung	47	0.8	15	0.8	91	1.0	25	1.0	20	1.0	11	1.7
Other respiratory	0	0	0	0	0	0	0	0	2	3.3	0	0
Bone	2	1.6	2	2.3	1	0.5	2	1.4	1	2.0	0	0
Connective tissue	3	1.2	1	0.6	4	1.0	2	0.8	1	1.1	0	0
Melanoma	1	² 0.1	0	³ 0	2	³ 0.2	2	³ 0.2	0	0	3	1.2
Breast	1	1.6	50	³ 0.7	0	0	47	³ 0.4	0	0	17	0.6
Cervix	...	...	29	³ 2.5	...	...	35	³ 2.1	...	...	17	³ 4.0
Ovary	...	...	12	0.9	...	...	8	² 0.4	...	...	5	1.1
Uterus	...	...	6	³ 0.2	...	...	3	³ 0.1	...	...	1	³ 0.1
Other female genital	...	...	2	0.8	...	...	1	0.3	...	...	0	0
Prostate	40	0.9	...	...	18	³ 0.3	...	...	7	0.5	...	...
Testis	9	1.6	...	...	5	0.6	...	...	2	0.9	...	...
Other male genital	2	2.4	...	...	2	1.6	...	...	1	3.4	...	...
Bladder	5	³ 0.2	1	0.2	10	³ 0.3	2	² 0.3	3	0.4	4	2.3
Kidney	11	1.3	7	1.7	11	0.8	15	³ 2.4	4	1.3	4	2.7
Eye	1	1.0	1	1.4	1	0.7	0	0	0	0	1	4.0
Brain	5	0.7	0	² 0	5	0.5	6	0.8	1	0.4	1	0.6
Other nervous system	0	0	1	2.9	0	0	0	0	0	0	0	0
Thyroid	5	1.8	11	1.6	2	0.5	10	1.0	0	0	4	1.6
Other endocrine system	1	1.7	0	0	2	2.1	0	0	0	0	0	0
Leukemia	10	0.8	3	0.4	6	³ 0.3	5	0.4	2	0.5	1	0.4
Lymphoma	7	0.5	6	0.6	12	² 0.6	3	³ 0.2	6	1.1	3	0.8
Multiple myeloma	9	² 2.8	2	0.9	1	0.2	1	0.3	1	0.9	0	0
Unknown	17	1.6	20	³ 2.3	25	² 1.6	33	³ 2.7	9	² 2.4	7	2.5

¹ Expected number based on SEER rates for U.S. whites and population figures from the 1970 and 1980 census for Alaska Indians, Eskimos, and Aleuts.

² 0.01 < P ≤ 0.05.

³ P ≤ 0.01.

languages are recognized: Inupiaq in northern Alaska, Central Yupik in southwestern Alaska, Siberian Yupik on St. Lawrence Island, and Sugpiag on the North Pacific Rim. As a result of Russian influence, some of the North Pacific Rim Eskimos classified themselves as Aleuts in IHS records. Based on linguistic studies, the true Aleut language was spoken only by those who originally occupied the end of the Alaska Peninsula and the Aleutian Island Chain.

We present cancer frequency data by linguistic group as well as by ethnic group (Indian, Eskimo, and Aleut). However, it was only possible to calculate rates by ethnic group since census data is by ethnic classification and there are no detailed tabulations of Native linguistic groups by age and sex. Differences in occurrence of cancer site by

linguistic group were examined with chi-square analysis using the Bonferroni method to account for multiple tests (5).

Observed-to-expected (O:E) ratios were determined. Observed cases of cancer were the number registered during the stated period. Expected cases of cancer were calculated using age- and sex-specific incidence rates from the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) Program (6) and population counts for Alaskan Indians, Eskimos, and Aleuts from the 1970 and 1980 censuses. The statistical significance of the O:E ratio was tested by the method of Bailar and Ederer (7).

We examined the data for trends in incidence over the 15-year period. Results are presented for Indians and Eskimos only; there were not enough

Table 2. Observed percent of cancer for select cancer sites by linguistic classification of patient, male Alaska Natives, 1969-83

Site	Indian		Eskimo			Aleut (N = 44)	Total (N = 710)
	Athabascan (N = 130)	Tlingit ¹ (N = 120)	Yupik ² (N = 200)	Inupiat (N = 169)	Sugpiaq (N = 47)		
Nasopharynx.....	3	2	5	6	11	7	5
Esophagus.....	2	2	5	1	2	2	3
Stomach.....	5	3	5	12	4	7	6
Colon.....	13	12	14	11	13	7	12
Rectum.....	9	3	2	7	2	5	5
Liver.....	1	1	8	5	0	2	4
Gallbladder.....	1	3	2	1	0	2	2
Pancreas.....	2	2	5	4	4	0	3
Lung.....	25	10	24	22	28	14	21
Prostate.....	5	24	5	5	9	7	9
Testis.....	5	2	1	2	2	2	2
Bladder.....	1	3	3	2	2	5	3
Kidney.....	6	3	3	4	6	2	4
Lymphoma.....	2	4	3	4	4	9	3
Leukemia.....	2	4	2	2	0	5	2
Multiple myeloma.....	1	5	1	0	0	2	1
Other sites.....	11	16	8	8	9	14	10
Unknown site.....	6	3	7	6	4	9	6

¹ Includes Haida and Tsimshian. ² Includes St. Lawrence Island Eskimos.

Table 3. Observed percentage of cancer for select cancer sites by linguistic classification of patient, female Alaska Natives, 1969-83

Site	Indian		Eskimo			Aleut (N = 56)	Total (N = 668)
	Athabascan (N = 120)	Tlingit ¹ (N = 104)	Yupik ² (N = 176)	Inupiat (N = 148)	Sugpiaq (N = 64)		
Salivary.....	3	0	2	2	0	0	1
Nasopharynx.....	2	2	3	3	3	0	2
Other oral.....	3	2	1	3	2	5	2
Stomach.....	5	1	1	3	2	0	2
Colon.....	12	9	17	15	13	16	14
Rectum.....	7	3	3	3	5	11	5
Gallbladder.....	3	6	5	5	0	2	4
Pancreas.....	1	2	3	2	6	9	3
Lung.....	5	8	9	5	9	9	7
Breast.....	13	30	14	14	17	11	17
Cervix.....	11	13	7	14	17	9	11
Ovary.....	6	2	2	3	3	5	3
Bladder.....	1	0	0	1	3	4	1
Kidney.....	4	1	6	3	5	2	4
Thyroid.....	4	6	4	2	3	2	4
Multiple myeloma.....	0	1	0	1	0	0	0
Other sites.....	13	11	15	12	9	9	12
Unknown site.....	8	6	8	9	3	7	8

¹ Includes Haida and Tsimshian. ² Includes St. Lawrence Island Eskimos.

Aleut patients to give reliable trends over time. Age-adjusted incidence rates for three 5-year periods were calculated and tested for significance by extension of the Mantel-Haenszel procedure (8).

Results

For the 15-year period 1969-83, 1,475 new cases of invasive cancer were diagnosed in Alaska Na-

tives. Ten of the 1,475 were known to be Alaska Natives but could not be assigned to an ethnic group. Fifty-seven patients were Native, but not enough additional information was available on these patients for them to be assigned to a linguistic group.

Of the 1,475 cancer cases, 92 percent were confirmed by histology, 2 percent by radiology, and 1 percent by direct observation. There were 41

“death certificate only” cases, and for these, the date of death was used as the date of diagnosis. The number of cases with death certificate information only decreased from 26 in the earliest 5-year period to 8 and 7 in the two subsequent 5-year periods.

O:E ratios for cancer at specific sites and total cases are shown for men and women by ethnic group in table 1. Tables 2 and 3 show cancer cases for the more frequently diagnosed sites by linguistic group for men and women respectively.

The only cancer for which O:E ratios are significantly increased in both men and women of all ethnic groups is cancer of the nasopharynx. Ratios range from 10 to more than 30. Patients with cancer of the nasopharynx have been diagnosed in all linguistic subgroups. Salivary gland cancer ratios are four and five in Eskimo and Indian women; no cases were diagnosed in Aleuts. Men in all ethnic groups have low ratios for oral and pharyngeal cancer other than that in the nasopharynx and salivary gland. In women, the risk for other oral cancer is not significantly low; O:E ratios are nearly three in Aleut women.

O:E ratios are high for both men and women in all ethnic groups for many cancer sites in the gastrointestinal tract. Ratios for esophageal, liver, and gallbladder cancer are particularly high in Eskimos of both sexes, for stomach cancer in Eskimo men, and for colorectal and pancreatic cancer in Aleut women. Ratios are also high for gallbladder cancer in Indians and significantly high in women. By linguistic group, gallbladder cancer appears to occur equally often in Yupik and Inupiat Eskimos, esophageal cancer predominantly in the Yupik, and stomach cancer more often in Inupiat. Liver cancer was found predominantly in the Yupiks, with the lowest rates in Indians and Aleuts. Differences in liver cancer by linguistic groups were significant in men at the 5 percent level.

Lung cancer rates are as high in Native groups as in U.S. whites, but laryngeal cancers are consistently low. Melanoma rates are also significantly low.

Native women are at increased risk for cervical cancer. Ratios are low for breast, ovarian, and especially uterine cancer. Among the Indian groups, it appears that Tlingit Indians are at greater risk than Athabascans for breast cancer.

For prostate cancer, ratios are significantly low ($P < .01$) in Eskimos, low in Aleuts, and 1.0 in Indians. As with breast cancer, Tlingit Indians are more likely to develop prostate cancer than Atha-

‘In Alaska, lung cancer is already the second most frequently diagnosed invasive cancer, and smoking prevalence among adult Natives has been found to be as high as 60 per cent.’

bascans; this ethnic difference is significant at the 5 percent level.

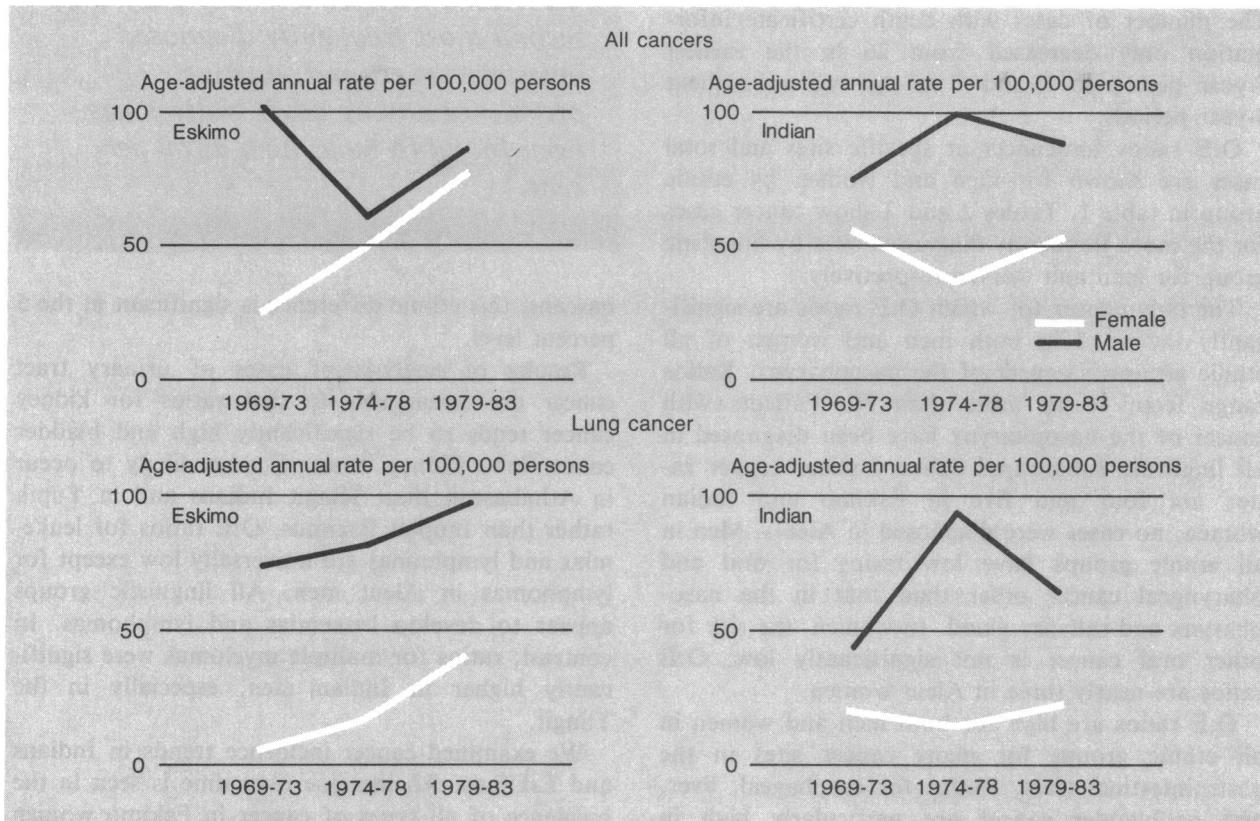
Results of analysis of cases of urinary tract cancer are remarkable in that ratios for kidney cancer tends to be significantly high and bladder cancer low. Kidney cancer is more likely to occur in Athabaskan than Tlingit Indians and in Yupik rather than Inupiat Eskimos. O:E ratios for leukemias and lymphomas are universally low except for lymphomas in Aleut men. All linguistic groups appear to develop leukemias and lymphomas. In contrast, ratios for multiple myelomas were significantly higher in Indian men, especially in the Tlingit.

We examined cancer incidence trends in Indians and Eskimos. An increase over time is seen in the incidence of all types of cancer in Eskimo women (fig. 1), although this did not quite achieve statistical significance ($P = .059$). The incidence of lung cancer has significantly increased in male and female Eskimos combined and in Eskimo women alone. Cervical cancer has increased in Eskimo and Indian women; the trend was significant in Indians (fig. 2). Breast cancer trends appear to differ in Eskimos and Indians. Prostate cancer appears to be increasing in both, although the trend was not significant in either Eskimos or Indians. Overall, none of the more frequently occurring cancers show a downward trend.

Discussion

Results of the 15-year incidence study of Alaska Natives agree with the results of previous Alaskan surveys (1-3). The site-specific cancer incidence rates in Alaska Natives differ markedly from those of U.S. whites. High rates are documented in more than one ethnic group for cancer of the nasopharynx, salivary gland, liver, gallbladder, and cervix. Low rates are found for cancer of the breast, uterus, bladder, melanoma, and oral-pharyngeal cancer in men excluding nasopharynx and salivary gland.

Figure 1. Age-adjusted average annual incidence rates per 100,000 for three 5-year periods for male and female Alaskan Eskimos and Indians for total cancers and cancer of the lung



It is important to note that overall cancer incidence in Alaska Natives is nearly equal to that of U.S. whites. Mortality data for all American Indians-Alaska Natives and incidence data for American Indians from the New Mexico SEER Program, which includes Indians only in two States, New Mexico and Arizona, suggest cancer is less of a problem in American Indians than other U.S. populations (9-10). Incidence data from Alaska and a recent review of cancer mortality from all IHS areas indicate cancer rates are not low in all Indian populations in the United States (personal communication from Leslie Boss, Division of Cancer Prevention and Control, National Cancer Institute). Furthermore, survival rates among the Southwest Indian groups are also lower than in other U.S. populations (11).

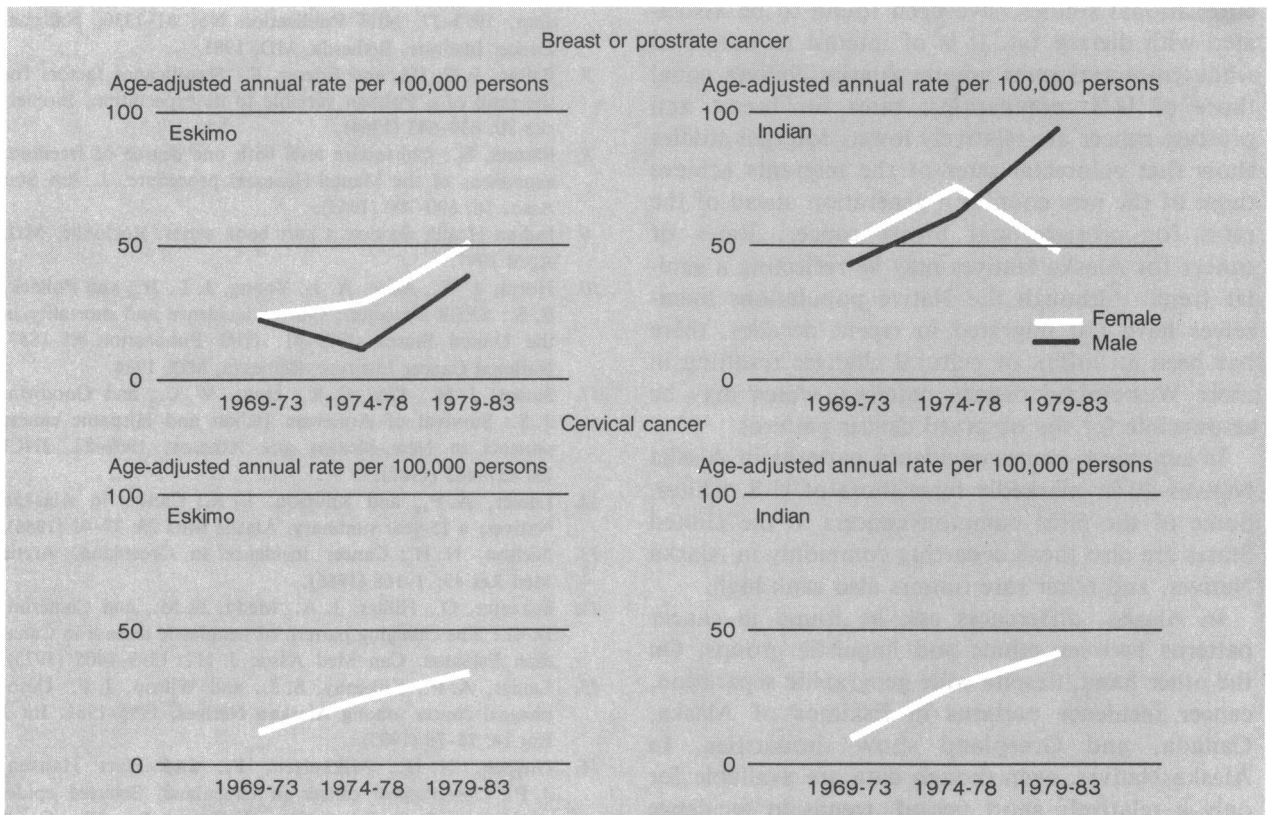
The Alaskan cancer data is particularly disturbing because the overall rate already approaches that of U.S. whites (12). Furthermore, rates for several sites (lung, breast, prostate, cervix) show increases, while no sites show declines in incidence rates. This suggests cancer rates may soon exceed those of U.S. whites. The Alaska Native people as well as health care providers have witnessed the emergence

of cancer in their communities and expressed alarm and concern.

These data underscore the need for optimal prevention and control programs. Because of the difference in cancer patterns in Native American groups in different parts of the country, cancer control programs may have to be area specific. For example, rates of smoking and lung cancer continue to be low in Southwest Indians. In Alaska, lung cancer is already the second most frequently diagnosed invasive cancer, and smoking prevalence among adult Natives has been found to be as high as 60 percent. Tobacco smoking prevention programs for youth and smoking cessation programs for adults should be among the highest priority programs in Alaska. Cervical and breast cancers are among the most frequently diagnosed and are sites for which screening tests exist and are of proven efficacy. However, the widely distributed population, the distribution of health care providers and medical facilities, and costs of transportation to obtain screening tests or evaluate those who test positive must be considered in implementing cancer screening programs.

Just as cancer patterns appear to differ nationwide among American Indians, differences also

Figure 2. Age-adjusted average annual incidence rates per 100,000 for three 5-year periods for Alaskan Eskimos and Indians for cancers of the prostate in men and cancers of the breast and cervix in women



exist between ethnic groups in Alaska. Eskimos are at higher risk for cancer of the esophagus and liver and are at lower risk for cancer of the breast and prostate than other Alaska Native groups. Gallbladder cancer is high in both Eskimos and Indians and lowest among Aleuts. Multiple myeloma is low in Eskimos and Aleuts and highest in Indians; the rate for Indian men exceeds that of U.S. whites.

The Inupiat Eskimos of Alaska are linguistically related to the Inuit of Canada and Greenland. Despite their wide geographic separation, similarities in cancer patterns are found among Eskimos of Alaska, Canada, and Greenland. Data on cancer patterns have been reported for Inuit only through 1974 (13, 14). Eskimos in all areas are at high risk for cancer of the nasopharynx, salivary gland, and cervix and at low risk for cancer of the breast, uterus, and prostate, and for leukemia-lymphoma. Esophageal cancer rates are significantly higher in Eskimos in Greenland and Alaska, and possibly in Canada, than non-Eskimo populations in each area (15, 16). However, in Alaska, the Yupik, not the Inupiat, Eskimos appear to be at highest risk (15). Gallbladder and liver cancer ratios are significantly increased in Alaska Eskimos, but rates for these cancers are not

as high in Eskimos in the other two countries. Colorectal cancer rates among Alaska Eskimos and all Natives equal or exceed those of U.S. whites, while large bowel cancer in Greenland Eskimos is low relative to whites in Denmark (13). All Eskimo groups have documented dramatic increases in lung cancer over the last few decades (12-14).

From an etiologic perspective, it is of interest to note that for several sites for which there is increased risk (nasopharynx, salivary gland, liver, cervix, esophagus), viruses are strongly implicated as causative or contributing agents. Increased rates of liver cancer in Alaska are due to the increased prevalence of hepatitis B infection and carriage rates (17). HBV vaccination programs have been implemented that will eventually impact not only hepatitis, but primary liver cancer (18). The liver cancer problem has affected only certain subsets of the population. Esophageal cancer also demonstrates marked geographic variation (though a pattern different from that of liver cancer), while the other viral-associated tumors appear to affect all ethnic and linguistic groups similarly. Hopefully, explanations of such patterns will follow shortly on the heels of the HBV-liver cancer story.

Breast, prostate, and colorectal cancers are considered diseases of Western civilization, and in correlational studies have been found to be associated with dietary fat. It is of interest to note that while colorectal rates among Alaska Natives equal those of U.S. populations, rates for breast and prostate cancer are relatively lower. Migrant studies show that colorectal rates of the migrants achieve those of the new country a generation ahead of the rates for prostate and breast cancer. Rates of cancer for Alaska Natives may be reflecting a similar trend. Although the Native populations themselves have not migrated in recent decades, there has been an influx of cultural changes resulting in more Westernized dietary patterns, which may be responsible for the observed cancer patterns.

In summary, cancer incidence patterns in Alaska Natives differ markedly from those of U.S. whites. Some of the most common cancers in the United States are also those occurring commonly in Alaska Natives, and other rare tumors also rank high.

In Alaska, differences can be found in cancer patterns between ethnic and linguistic groups. On the other hand, despite wide geographic separation, cancer incidence patterns in Eskimos of Alaska, Canada, and Greenland show similarities. In Alaska Natives, even though data are available for only a relatively short period, trends in incidence indicate changing patterns of cancer in the population. In the face of changing patterns, it is important to monitor cancer incidence. In the meantime, the data should be used to focus cancer control program efforts. The lung cancer picture provides ample justification for major programs to curb the use of tobacco. Secondary prevention (screening) programs of proven utility should be applied as appropriate in the Alaskan setting. The unique cancer patterns of Alaskan Natives should continue to be examined in light of proposed hypotheses regarding cancer etiologies.

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