CANCER PATTERNS IN THE TRAIL AREA

A report to the Ministry of Health

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BRITISH COLUMBIA CANCER AGENCY
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25 September 1992

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Dear

Enclosed is a copy of the final report on Cancer in the Trail School District. Thank you for your help in putting together the final draft. I look forward to meeting you in Trail on October 6.

With best wishes,

Yours sincerely,

Rick

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EXECUTIVE SUMMARY

A study commissioned by the B.C. Ministry of the Environment and released June 26, 1991, indicated that soil levels of arsenic, cadmium, mercury, silver and zinc, were high in some neighbourhoods in Trail. The Epidemiology Division of the B.C. Cancer Agency was subsequently requested by the Ministry of Health to examine existing cancer mortality and incidence data to evaluate whether the Trail area had higher levels of cancer, which might be associated with community exposure to heavy metals.

Analysis of cancer deaths (mortality) for the years 1956-1989 and newly diagnosed cancers (incidence) for the years 1983-1989 in the Trail School District (#11) was carried out.

Examination of mortality and incidence patterns do not suggest that environmental contamination from heavy metals is leading to any increased risk of developing cancer.

INTRODUCTION

In 1989 the Trail Lead Study was undertaken in order to identify modifiable determinants of elevated blood lead levels in children age 2-6 in Trail. The study also compared the present blood lead situation in children with past studies of lead in Trail. The investigation demonstrated that the average blood lead level among children in Trail had declined dramatically since the late 1970's, when a previous study had been done[1]. However, some remaining concerns were identified; particularly an average blood lead level among children which was still higher than that seen in Vancouver. Furthermore, the high blood lead levels tended to concentrate in particular neighbourhoods close to the Cominco Lead Zinc Smelter.

Evaluation of the findings from the lead study prompted the Ministry of the Environment to commission a further study to evaluate possible soil contamination by other metals in Trail[2]. Results of this study showed substantially elevated levels of arsenic, cadmium, copper, mercury, silver and zinc in the soil, with the highest levels of these metals occurring in the same neighbourhoods with the highest lead levels. The correlation of levels of other heavy metals with levels of lead suggests that they are likely emanating from the same source as the lead in the soil, namely the smelter.

Because of concern about potential long-term effects should exposure to these metals occur, the Ministry of the Health requested that the Division of Epidemiology, Biometry and Occupational Oncology examine incidence and mortality from cancer in the Trail area.

Cancer mortality data from 1956 through 1989 for the Trail School District

(S.D.#11) was therefore evaluated, along with incidence data for the years 1983 through 1989.

METHODS

Mortality Data

Data on all cancer deaths occurring in the province of B.C. from 1956 through 1989, were provided by the Division of Vital Statistics (DVS) in Victoria. Information on each death included age or birth date, sex, and place of residence of the decedent as well as immediate, contributory and underlying causes of death. Only underlying cause of death was used in the present analysis.

Data was available on 71,508 male and 56,279 female cancer deaths occurring in the province.

Cause of death information recorded on the death registrations was coded by DVS nosologists over the 34 year period according to the 6th, 7th, 8th and 9th revisions of the International Classification of Diseases[3-6]. All codes were reconciled to the 7th revision format for this study.

British Columbia has 75 School Districts, and this administrative division was chosen for analysis of the death data, as the boundaries of the school districts have remained stable over the period of the study. No major changes have been seen in the boundaries for School District #11.

Populations for each school district, and for the province as a whole, were obtained from the Central Statistics Bureau of the Ministry of Finance and Corporate Relations. Figures by sex and 5-year age group were available for the census years

1971, 1976 and 1981, and estimated populations for the inter-censal years 1982-1989. Populations by 5-year age group, but not sex, were obtained for the census years 1956, 1961 and 1966, and the sex breakdown for these earlier years was estimated from the sex distribution of the later populations. Linear interpolation was used to estimate populations by school district for inter-censal years.

For each cancer type or site, standardized mortality ratios (SMR) were calculated by sex and by school district. The SMR compares the ratio of the observed number of deaths in a particular school district; in this case Trail, with the number of deaths expected in that school district based on the provincial mortality rate. All rates were age standardized to the 1971 B.C. population. This ratio was then multiplied by 100 to give the SMR. Statistical significance of elevated or reduced SMR's was assessed by assuming that the observed number of deaths in each area followed a Poisson distribution.

Incidence Data

Although mortality data is available for much longer historical periods than cancer incidence data, the information on death registrations has well recognized inaccuracies and limitations. Cause of death coding may lack precision and determination of the primary tumour may be difficult in patients dying of widespread metastases[7]. Also, cancer patients with tumours which have a good prognosis may die from other causes without the cancer being recorded on the death registration[8,9].

Incidence data - that is information based on new diagnoses of cancer rather than deaths from cancer - is thus superior, in general, to mortality data for the evaluation of cancer patterns and trends.

The British Columbia Cancer Registry collects incidence data on all newly diagnosed cases of cancer among the residents of the province. These data are provided to the Registry from laboratories throughout the province in the form of duplicate copies of pathology reports mentioning malignancy. Unfortunately the copies of the pathology reports seldom give the patient's residence address. Thus, although the numbers of new cases of cancer diagnosed in the province each year is known with accuracy, pin-pointing exact residence address has historically been a problem.

The Division of Epidemiology at the Cancer Agency undertook a retrospective survey of residence at diagnosis of B.C. patients diagnosed from 1983 through 1989. Address and postal code were obtained through hospital and physician records, where available, for all cases diagnosed during this time period.

Of the incident cases from 1983-1989, school district of residence at diagnosis was available on over 97%. Postal code was available for 90% of the incidence cases. Complete residence address at diagnosis was lacking on about 12% of cases.

Standardized incidence ratios (SIR) for each school district, including Trail, were calculated using indirect age standardization to the 1971 B.C. population. Calculations were analogous to those carried out for mortality and the ratio of observed incidence cases to expected (based on provincial rates) was again multiplied by 100. Significance of SIR values differing from 100 was assessed by comparison with the Poisson distribution[10].

RESULTS

Mortality

Cancer mortality for males and females for the overall period 1956-1989 is presented in Table 1, with numbers of deaths, standardized mortality ratios (by comparison with the rest of the province), and where the School District ranks out of the 74 districts surveyed for each cancer.

For all cancers combined the male SMR is virtually exactly what would be expected; that is the rates of male cancer for the School District of Trail is the same as the rate for the entire province. For females the SMR is about 10% less than anticipated based on the province as a whole and this value is statistically significant.

Overall in the table several SMR's are significantly elevated and several significantly lower than anticipated. Cancers of the oropharynx in males, colon and genito-urinary system in females are lower than expected, while breast cancers in males and cancers of the small intestine in females are significantly elevated. It should be noted that most of the elevated and reduced SMR's are based on relatively small numbers of deaths over the 34 year period. Hence concern about a particularly high or low SMR (for instance SMR=460.5 for male breast cancer) should be tempered by the knowledge that a difference of one death would make a major difference in the SMR.

Lung cancer excesses have been reported in several studies of populations with substantial exposure to either arsenic or cadmium[11,12,13]. Non-melanocytic skin cancer has also been reported to be more common in cohorts exposed to arsenic. It has also been suggested that prostate cancer may be elevated in workers constantly exposed to cadmium[13].

Because lung cancer is cancer of concern, we evaluated mortality from this cause over four time periods in Trail - 1956-63, 1964-71, 1972-80, and 1981-89 as shown in Table 2.

Elevated mortality for lung cancer is seen among males in the final period, with an SMR of 130 indicating about 30% more deaths than anticipated from this cause in men. No significantly elevated risks are seen in other periods for males. Also no significantly elevated SMR's are seen for any time period among females.

A total of 5 deaths were attributed to non-melanocytic skin cancer, however, these were all in males. If an environmental agent were responsible for these cases one would expect that an excess would be seen in both males and females.

Incidence

As noted earlier, cancer incidence data is, in general, more useful than mortality data in evaluating cancer trends and geographic patterns.

Incidence figures for 1983 through 1989 indicate statistically significant excesses of cancer of the testis among men and pancreatic cancer in women (Table 3). Significant deficits in incidence were seen for kidney and brain cancer in males and ovarian cancer in females. No statistically significant excesses were found in either males or females for lung cancer or prostate cancer, the tumours which might be expected to be elevated. Although the SIR for male lung cancer is almost 20% higher than expected, this may simply be due to chance.

CONCLUSIONS

The findings from our review of deaths over the period 1956-1989 do not suggest that mortality from cancer in Trail (School District #11) is higher than anticipated in either males or females, by comparison with the province as a whole. Over the entire time period no excesses are seen in either lung or prostate cancer in males, or lung cancer in females - the sites which might be expected to be elevated.

The only statistically significant excess in cancer mortality from 1956-1989 in the Trail School District is seen among females for cancer of the small intestine (PMR=299, $p<.05$). This finding is based on a small number of deaths (5) and no corresponding excess is seen in males. Since no previous studies have suggested an association between tumours of the small intestine and metal exposure, it would seem unlikely that these deaths could be attributed to high levels of metals in the local environment.

Evaluation of lung cancer mortality by time period suggest that an excess of deaths occurred among males (SMR = 130) during the time period 1981 though 1989 in School District #11. The excess is seen only in males and only in recent years, rather than in earlier time periods, and these facts argue against community exposure to a carcinogen.

The statistically significant excess of lung cancer deaths seen in males from 1981-1989 is mirrored by a similar elevated standardized incidence ratio (SIR = 119) for newly diagnosed incident lung cancers from 1983-1989 although this is not statistically significant. No corresponding excess of lung cancer incidence is seen in females.

Two cancer sites, one in males and one in females, appear to have significantly elevated incidence for the years 1983-1989. These are cancer of the testes in males (SIR = 215) and pancreatic cancer in females (SIR = 249). Neither of these cancers have been related to heavy metal exposure. It should be noted however that statistically significant deficits are also seen in males in cancers of the kidney (SIR = 22) and brain (SIR = 17), and in females for endometrial cancer (SIR = 31).

This examination of incidence and mortality data from the Trail School District does not suggest that environmental contamination from heavy metals is associated with an elevated risk of developing cancer.

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TABLE 1

Cancer Mortality, Trail School District (S.D.#11) 1956-1989 by Site and Sex

Site	Males Number	Males SMR[1]	Males Rank	Females Number	Females SMR[1]	Females Rank
Lip	0	0.00	49.0	0	0.00	39.5
Oral Cavity	1	13.77*	65.0	5	139.14	20.0
Oropharynx	1	69.78	29.0	0	0.00	47.5
Nasopharynx	0	0.00	56.0	0	0.00	52.5
Hypopharynx	0	0.00	51.5	0	0.00	46.0
Pharynx	2	29.89	59.0	1	39.30	45.0
Esophagus	24	145.06	5.0	6	92.53	29.0
Stomach	59	111.69	12.0	28	116.26	18.0
Small Intestine	0	0.00	57.5	5	299.23*	4.0
Colon	49	91.56	33.0	34	67.62*	65.0
Rectum	25	90.69	37.0	20	116.75	21.0
Liver	9	92.59	24.0	5	102.98	32.0
Gallbladder	6	87.08	39.0	11	115.49	33.0
Pancreas	46	115.22	12.0	29	108.55	26.0
Nose and Nasal Sinus	0	0.00	53.0	0	0.00	51.5
Larynx	5	70.38	44.0	0	0.00	58.0
Lung	205	104.16	14.0	55	88.30	45.0
Pleural Cavity	3	164.33	16.0	0	0.00	47.0
Breast	3	460.54*	5.0	105	100.22	30.0
Cervix				11	61.87	65.0
Endometrium				9	70.20	53.0
Ovary				27	75.89	47.0
Prostate	68	103.91	37.0			
Testis	4	199.43	9.0			
Kidney	17	101.73	30.0	5	64.55	55.0
Bladder	18	83.79	45.0	4	56.35	58.0
Melanoma	7	108.41	16.0	5	97.52	38.0
Non-Melanoma Skin	5	204.32	9.0	0	0.00	57.5
Eye	1	106.78	20.0	2	322.16	7.0
Brain and Nervous	14	64.51	59.0	17	115.16	19.0
Thyroid	2	154.03	15.0	2	89.35	37.0
Bone	3	115.22	24.0	0	0.00	59.0
Soft Tissue Sarcoma	5	174.47	12.0	0	0.00	62.0
Lymphosarcoma	27	134.88	8.0	11	78.77	47.0

TABLE 1 (continued)

Cancer Mortality, Trail School District (S.D.#11) 1956-1989 by Site and Sex

	Males			Females		
Site	Number	SMR[1]	Rank	Number	SMR[1]	Rank
Hodgkin's Disease	4	75.93	40.0	2	70.62	45.0
Myeloma	7	69.73	55.0	6	81.16	45.0
Leukemia	27	94.50	41.0	21	115.50	12.0
All cancer	675	100.96	16.0	447	89.89*	60.0
All deaths	2911	97.37	40.0	1930	101.98	40.0

* Means Significance <0.05
& Means Significance <0.01
1 SMR = Standardized Mortality Ratio

TABLE 2

Lung Cancer Mortality: Trail School District (S.D. #11) by Time Period 1956-1989

	Male			Female		
	No. Deaths	SMR[1]	Rank	No. Deaths	SMR[1]	Rank
1956-1963	28	114	11	4	113	20
1964-1971	28	71	48	5	73	44
1972-1980	54	86	46	19	108	30
1981-1989	95	130**	10	27	81	54

** P<.01

1 SMR = Standardized Mortality Ratio

TABLE 3

Cancer Incidence, Trail School District (S.D.#11) 1983-1989 by Site and Sex

Site	Males Number	Males SIR[1]	Males Rank	Females Number	Females SIR[1]	Females Rank
Lip	1	36.36	58.0	0	0.00	51.0
Mouth/Pharynx	8	86.05	33.0	2	41.58	53.0
Esophagus	5	107.76	32.0	1	47.70	38.0
Stomach	13	107.55	30.0	5	84.28	38.0
Colon	21	78.53	53.0	20	77.37	60.0
Rectum	17	87.95	53.0	16	114.96	24.0
Liver	3	90.97	27.0	0	0.00	59.5
Pancreas	11	134.51	16.0	17	248.94&	5.0
Larynx	3	55.76	60.0	0	0.00	55.5
Lung	75	119.66	16.0	27	87.28	47.0
Soft Tissue Sarcoma	5	111.09	13.0	1	39.45	55.0
Melanoma	9	98.72	30.0	8	86.83	46.0
Breast				96	113.85	5.0
Cervix				4	52.50	62.0
Endometrium				18	103.77	26.0
Ovary				4	31.09*	70.0
Prostate	89	105.10	26.0			
Testis	7	215.33*	3.0			
Bladder	16	100.98	34.0	2	41.37	58.0
Kidney	2	22.31*	68.0	5	108.76	37.0
Brain	1	17.36*	71.0	7	181.06	6.0
Hodgkin's Disease	2	98.19	34.0	1	66.78	43.0
Non-Hodgkin's Lymphoma	13	107.27	22.0	6	64.48	62.0
Multiple Myeloma	8	185.31	13.0	2	60.40	52.0
Leukemia	11	109.44	25.0	5	77.13	46.0
Other Sites	13	117.38	19.0	18	134.08	10.0
Primary Unknown	17	79.18	51.0	14	84.57	51.0
All Cancers	350	100.00	27.0	279	95.79	36.0

* Means Significance <0.05
& Means Significance <0.01
[1] SIR = Standardized Incidence Ratio