Lung cancer among iron ore miners in east Slovakia: a case-control study

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The biological effects of ionising radiation (BEIR IV) report included a summary of risks of lung cancer in cohorts of miners exposed to radon daughters,¹ and concluded that "without exception, these studies indicate an excess probability of death due to lung cancer ..." Iron ore mines have been in operation at Roznava and Nizna Slana in east Slovakia throughout this century. The mines, which are 10 km apart, are major employers in the area. Data on radiation exposures and dust concentrations are available for the period 1980-89. Local authorities found average levels of α radiation from radon and its daughters to be 0.13 WL (working levels) in the Roznava mine and 0.091 WL in the Nizna Slana mine. Average concentrations of total dust in the two mines are similar (Roznava 2.6 mg.m⁻³, Nizna Slana 2.4 mg.m⁻³). During drilling operations, dust concentrations are about 15 mg.m⁻³. Principal components of ores from the two mines are similar (oxides of iron, manganese, magnesium, calcium, phosphorus, and arsenic together with silica, sulphur, and carbon). Diesel machinery was introduced into the Nizna Slana mine in 1973; Roznava still uses electrically powered machinery.

Evidence of occupational lung cancers arising from employment in these mines has been reported before.^{2,3} A case-control study has now been carried out to quantify the likely risks associated with employment in each mine.

(Occup Environ Med 1994;51:642-643)

Material and methods

Cases comprised all new cases of lung cancer diagnosed in the period 1980-1989 at the

Department of Clinical Oncology, Roznava, among men resident in the Roznava (n = 140) or Nizna Slana areas (n = 60). Cases were classified as either ever or never employed as an underground iron ore miner on the basis of occupations recorded in hospital notes. All cases were registered with one of the five local general practitioners. Controls were selected from lists of patients registered with these five local general practitioners. Records for every tenth man in these lists were selected; 196 controls from the practice lists of the three general practitioner surgeries in the Roznava area and 228 controls from the two general practitioner surgeries in the Nizna Slana area. Controls were classified as ever or never employed as underground iron ore miners on the basis of occupational data held by the general practitioners and on information received from them.

An estimate of the relative risk of lung cancer associated with iron ore mining was provided by a Mantel-Haenszel analysis after controlling for age (year of birth).⁴

Results

The table shows the data by area, case or control state, and occupation. Increased relative risks are associated with iron ore mining in both areas (Roznava: RR 2.81, 95% confidence interval (95% CI) 1.69-5.21; Nizna Slana: RR 4.01, 95% CI 2.07-9.06). The proportion of cigarette smokers among miners with lung cancer was 77% for the Roznava series and 60% for the Nizna Slana series. Duration of mining employment was available for 42 of the Roznava cases and 14 of the Nizna Slana cases. Mean durations of mining employment for these two groups of cases were 25.5 years and 23.4 years respectively,

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Relative risk of incidence of lung cancer among iron ore miners[†] in two districts of east Slovakia

Year of birth	Roznava				Nizna Slana			
	Cases		Controls		Cases		Controls	
	Miner	Non-miner	Miner	Non-miner	Miner	Non-miner	Miner	Non-miner
<1909	3	13	5	6	6	4	1	5
1910-19	29	10	8	18	8	11	5	18
1920-29	28	29	11	30	9	7	9	45
1930-39	15	7	13	26	6	6	19	36
1940-49	1	3	2	26	3	0	5	30
1950-59	0	1	3	27	0	0	0	30
1960-69	0	1	1	21	0	0	1	24
Total	76	64	43	153	32	28	39	189
Relative risk (95% CI)	2.81*** (1.69-5.21)				4.01*** (2.07-9.06)			

***P < 0.001.

[†]Ever or never employed as an underground iron ore miner.

providing estimated cumulative radiation doses of 37.5 WLM and 24.0 WLM. Corresponding data for miners in the two control series are not available.

Discussion

The case series are likely to be complete because it is obligatory for cases of cancer to be registered at the local clinic. It is unusual for ex-employees to leave the local area, and one feature of the centrally run economy that existed until recently was a lack of mobility in the workforce. The miner or non-miner classification will, therefore, approximate to a life long classification.

The study is limited by the absence of data on smoking for cases and controls, the use of different sources of information for the occupational classification, and the absence of

cumulative exposure estimates. It seems clear, however, that excess risk of lung cancer is present. There are a number of carcinogens or potential carcinogens present in the mines and it is not possible, from these data, to attribute risks to the various exposures present. Working conditions may have to be improved in several ways before it will be possible to state with any confidence that occupational lung cancers will cease to occur.

- 1 National Research Council, Committee on the Biological Effects of Ionizing Radiation (BEIR IV). *Health risks of radon and other internally deposited alpha-emitters*. Washington, DC: National Academy Press, 1988.
- 2 Pekárek V. Radon a jeho dcerinné produkty v ovzduší rudných dolů severočeského kraje a výskyt profes. rakoviny plic u exponovaných horníků. *Pracov Léč* 1982;34: 270–2.
- 3 Icsó J, Szöllősová M. Výskyt pľúcnej rakoviny u baníkov železorných bani. *Pracov Léč* 1984;36:294–8.
- 4 Mantel N, Haenszel W. Statistical aspects of the analysis of data from retrospective studies of disease. *J Natl Cancer Inst* 1959;22:719–48.