

AN EPIDEMIOLOGICAL STUDY CONCERNING HERBICIDES

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A preliminary study of 324 Swedish railway workers exposed to herbicides between the years 1957—1971 showed 2 excess lung cancer cases, 1 adenocarcinoma and 1 oatcellcancer. Although the number of subjects was small, especially the number of cancers, the possibility that amitrole and combinations together with smoking might have caused the excess lung cancers cannot be ruled out.

Many different herbicides have been used on Swedish railways since 1955. The workers have been afraid of getting ill due to exposure to herbicides particularly since debate about excess cancer risk in this type of work last year.

This preliminary study was made on request of the National Board of Occupational Safety and Health. It was conceived as a retrospective epidemiological study concerning all workers exposed to herbicides during the years 1957 to 1971, but there was a limitation of the number of subjects since only workers exposed for more than 45 days were included in the study. The total number of deaths, the number of deaths from tumours and deaths from lung cancer were determined.

In the literature concerning the use of herbicides the results of animal experiments have been reported in which amitrole (3-amino-triazole) has been suspected of cancerogenic effects, especially in the thyroid gland. A report from the U.S. Department of Health, Education and Welfare 1969 says that amitrole is »judged positive for tumour induction on the basis of tests conducted adequately in two or more species«. It states further that »It is recommended that the exposure of human beings to pesticides in this category be minimized and that use of these pesticides be restricted to those purposes for which there are judged to be advantages to human health which outweigh the potential hazard of carcinogenicity«. For monuron (chlorophenyl 1,1-dimethylurea) the same report says: »The following compounds yielded an increased tumour incidence significant at the 0,01 level but were considered less tumourogenetic than the mean group of a positive control«. For diuron (dichlor-

phenyl 1,1-dimethylurea) there is no information in the literature revealing suspicions of potential carcinogenicity. For phenoxyacetic acids (2,4-D and 2,5,5-T) there is no positive indication of cancerogenicity for pure preparations, but the problem with dioxines and carcinogenicity is still unsolved.

METHOD

It was decided to take into epidemiological study all workers exposed to herbicides for more than 46 days, during the years 1957—1971. A total of 324 subjects was studied in four overlapping groups which were as follows:

- 1) all exposed workers (324 workers)
- 2) workers exposed mainly to amitrole and combinations (143 workers)
- 3) workers exposed to phenoxyacetic acids and combinations (194 workers)
- 4) workers exposed to other herbicides and combinations including amitrole (28 workers)

From Table 1 it is possible to see many different herbicides used during this period. During the years 1957—1961 the total amount of herbicides was about 45—50 tons per year. This includes amitrole since 1958. After 1962 it is possible to see different amounts of herbicides used, the main herbicide being a combination of amitrole and diuron, what makes diuron an inseparable factor in the amitrole group. After 1963 phenoxyacetic acid was used as a mixture of 2,4-D + 2,4,5-T with the total consumption of about 10.000 litres per year.

The type of aggregate used, on the railways for spraying herbicides mostly amitrole and diuron is shown in Fig. 1.

RESULTS

In Table 2 are presented the observed and expected total deaths, tumour deaths and lung cancer death rates during the years 1957—1972 in the four different groups. The 0 year latent period means that a worker's years under risk were calculated immediately after he had sprayed for 46 days. A significant difference was found at a 5% level for lung cancer in the amitrole group. With a latent period of 3 years, the worker's years under risk were calculated except for the first 3 years after he had been exposed to herbicides up to 46 days. Even in this way only excess lung cancers are found in the amitrole group. The same is the case if a latent period of 5 years is used. Here the significance is at a 2% level.

Table 1
Herbicides used 1957—1971

Herbicide	Active ingredients	Tons															
		1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	
Totex	Atrazin M M	57,1	×														
Ureabor	Dinatriumtetraborat + monuron	×	×	×	×												
Karmex	Diuron					×											
Telwar	Monuron			×	×		0,29										
Hyvar	Bromacil							1,0									
Primatol A	Atrazin		×	×	×		3,7										
Primatol D43	Atrazin + mecoprop + 2,4,5-T							4,0									
Emisol 100	Amitrol		×	×	×		7,2	2,3	5,7	5,6	4,9	1,1	1,4	1,2	1,3	0,9	
Emisol 50	Amitrol					×											
Weedex tel	60% amitrol + 40% monuron										1,2						
Weedex kar	60% amitrol + 40% diuron																
Total extra	Atrazin + diklorpropionsyra + 2,4-D + 2,3,6 TBA						3,8	19,5	22,5	23,0	22,4	26,0	21,3	21,4	20,2	19,6	
Uridal	Diuron + diklorpropionsyra									2,3		4,5	4,5	4,2			
Total		57,1	52,8	51,5	40,0	45,0	43,8	26,8	28,2	30,9	28,5	27,1	27,2	31,1	28,9	20,5	

The amounts of herbicides marked × are given only as a total.

Table 2
Observed and predicted total death, tumor and lung cancer 1957-1972

Herbicide	Death cause	Latent period											
		0 years			3 years			5 years					
		obs. pers. years	pred.	obs.	obs. pers. years	pred.	obs.	obs. pers. years	pred.	obs.			
All herbicides	Total	2,802	19,33	17	1,841	14,41	15	1,289	10,96	13			
	Tumor		4,59	5		3,47	5		2,66	5			
	Lung cancer		0,78	2		0,60	2		0,47	2			
Phenoxyacetic acid and combinations	Total	1,621	11,58	9	1,046	8,55	7	712	6,36	6			
	Tumor		2,76	1		2,06	1		1,55	1			
	Lung cancer		0,47	0		0,36	0		0,27	0			
Amitrole and combinations	Total	1,228	7,94	9	807	5,90	8	561	4,46	6			
	Tumor		1,87	4		1,41	4		1,07	4 ²			
	Lung cancer		0,32	2 ¹		0,24	2 ²		0,19	2 ³			
Other herbicides and combinations	Total	293	1,68	4	209	1,34	4 ¹	156	1,09	4 ²			
	Tumor		0,39	3 ⁴		0,32	3 ⁵		0,26	3 ⁶			
	Lung cancer		0,06	1		0,05	1 ¹		0,04	1 ¹			

¹ $p < 0,05$ ² $p < 0,3$ ³ $p < 0,02$ ⁴ $p < 0,01$ ⁵ $p < 0,005$



Fig. 1. The type of aggregate used for spraying herbicides on Swedish railways

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Sažetak

EPIDEMIOLOSKI STUDIJI UCINAKA HERBICIDA

U ovom preliminarom epidemiološkom istraživanju, autori su analizirali uzroke smrti među 324 radnika koji su u razdoblju od 1957. do 1971. godine bili izvrgnuti različitim herbicidima tijekom ukupno više od 46 dana. Autori su u račun uzimali incidenciju u općem i specifičnom mortalitetu švedske populacije pa su uspoređivali broj očekivanih i broj utvrđenih smrtnih slučajeva među eksponiranim radnicima. Premda su sveukupni brojevi maleni, ne može se isključiti mogućnost da je amitrol sam ili s pušenjem uvjetovao veći broj karcinoma pluća u eksponiranih radnika.

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