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Occupational solvent exposure and neuropsychiatric disorders

by Kari Lindström, PhD,¹ Hilikka Riihimäki, MD,² Kari Hänninen, MSc(Eng)²

LINDSTRÖM K, RIIHIMÄKI H, HÄNNINEN K. Occupational solvent exposure and neuropsychiatric disorders. *Scand J Work Environ Health* 10 (1984) 321—323. Long-term exposure to solvents has been shown to induce neuropsychiatric disorders in workers. In this case-referent study the cases comprised 374 construction workers who had been awarded a disability pension due to a neuropsychiatric disorder in 1978—1980. Their matched referents were selected from construction workers who had been granted a pension due to other diseases in the same three-year period. The results of this study indicate that solvent exposure increases the risk of being prematurely pensioned due to neuroses, but early pensioning due to alcoholism or other neuropsychiatric disorders is not increased by solvent exposure. This same conclusion has been reached in earlier studies on this matter in other countries.

Key terms: case-referent study, disability pensions, organic solvents, painters, carpetlayers.

Several psychological studies have shown that painters and other workers with solvent exposure have disturbed psychological functions and emotional reactions (3, 4, 6). Patients with solvent intoxication were found to have electroencephalographic abnormalities and also impairment in memory, concentration, and sensory and motor functions (1, 10). Persons exposed to solvents have shown, eg, changes in personality characteristics, generally in respect to affective-emotional reactions. Part of these changes are apparently secondary reactions to a lowered performance level and general health condition (5).

Swedish and Danish construction workers who have been granted a disability pension and who have been exposed to solvents have been shown to have increased morbidity due to neuropsychiatric disorders (2, 8). In a Danish cohort study painters had an increased risk to be pensioned due to presenile dementia (7).

The present retrospective case-referent study was undertaken to verify the results obtained in other Nordic countries and to determine the current situation in Finland.

Subjects and methods

This study was accomplished with a case-referent design. Both the cases and the referents were selected from the register of the Employment Pension Fund, which provides disability pensions to all the disabled construction workers in Finland. The subjects' age at the time the pension was granted was limited to

30—64 years in order to exclude those without pertinent exposure. The common retirement age in Finland is 65 years.

The cases comprised all male construction workers who had been granted a disability pension because of certain neuropsychiatric disorders during the period 1978—1980. The included diagnoses were the same (with the addition of psychosomatic disorders) as those used in the investigation of Axelson et al (2). The principal psychiatric diagnoses that were excluded were primary debility, schizophrenia, and mental diseases with obvious extraneous causes, like encephalitis, traumatic disorders, etc.

The neuropsychiatric diagnosis had to be the primary medical criterion for disability, with the exception of alcoholism, which was included whenever mentioned (table 1).

The referents were selected from the construction workers who had been granted a disability pension for reasons other than neuropsychiatric disorders. They were not allowed to have any sign of neuropsychiatric disorder among the criteria listed for disability. The primary diagnoses of the referents are presented in table 2.

The cases and the referents were matched pairwise with regard to the time of pensioning and age at that time within the range of two years. The material consisted of 374 pairs. The mean age of all the subjects at the time of pensioning was 49.1 years. That of the subjects with neurosis as the grounds for pensioning was younger (46.2 years).

Occupation was used as the indicator of solvent exposure. The information on occupation was obtained from the register, where it is recorded according to the men's own responses on the pension application form. Painters and carpetlayers were classified as the exposed group, while all other occupations were considered nonexposed.

¹ Department of Psychology, Institute of Occupational Health, Helsinki, Finland.

² Medical Research Bureau, Employment Pension Fund, Palkkatilaportti 1, SF-00240 Helsinki, Finland.

Reprint requests to: Prof K Lindström, Institute of Occupational Health, Laajaniityntie 1, SF-01620 Vantaa, Finland.

The statistical treatment of the data was carried out with the program given by Rothman & Boice for case-referent matched analysis (9). The Mantel-Haenszel chi square, the maximum likelihood estimate of the odds ratio, and its test-based confidence limits were calculated.

Table 1. The neuropsychiatric diagnoses of the cases. (ICD VIII = International Classification of Diseases, eighth revision)

Diagnosis (ICD VIII)	N	%
Alcoholism (303)	189	50
First disability criterion	63	
Second disability criterion	105	
Third—fifth disability criterion	21	
Dementia (290)	12	3
Affective or paranoid psychosis (296—297; excluding 296.10, 296.30)	31	8
Neurosis or persona pathologica (300—301)	103	27
Psychosomatic disease (305)	2	1
Perturbationis mentis per lesionem cerebri (309.20)	2	1
Cerebral atrophy (347.91)	18	5
Vertigo or encephalopathy (780.50, 781.70)	15	4
Nervositas (790; excluding 790.19)	2	1
Total	374	100

Table 2. The primary diagnoses of the referents.

Disease	N	%
Tumors	33	8
Diseases of the nervous system	20	5
Cardiovascular diseases	114	30
Respiratory diseases	29	8
Musculoskeletal diseases	104	28
Symptoms and poorly defined diseases	37	10
Other diseases	37	10
Total	374	100

Table 3. Solvent exposure among the matched pairs of the cases and the referents. (X^2 = McNemar chi square, NS = not significant)

Diagnosis of cases	Exposure ^a of cases	Exposure ^a of referents		Odds ratio	90 % confidence interval	X^2	p-Value
		Yes	No				
Alcoholism	Yes	0	18	1.1	0.6— 2.0	0.12	NS
	No	16	155				
Neurosis ^b	Yes	1	11	5.5	1.8—16.9	6.23	< 0.05
	No	2	94				
Other neuropsychiatric disease	Yes	0	6	1.5	0.5— 4.3	0.40	NS
	No	4	68				
Total	Yes	1	35	1.6	1.0— 2.5	2.97	< 0.10
	No	22	317				

^a Information based on occupation.

^b Neurosis, persona pathologica, psychosomatic disease, nervositas.

Results

Neuropsychiatric disorders were found to be associated with solvent exposure (table 3). Ten percent of the cases and 6 % of the referents were painters or carpetlayers.

When the diagnostic subgroups of neuropsychiatric disorders were considered, a statistically significant association was discerned between neuroses and solvent exposure, whereas no such association with regard to alcoholism or other neuropsychiatric disorders was found.

Because of the small number of solvent-exposed men, scrutiny for a dose-response relationship proved to be inexpedient. However, with the use of a crude division into two exposure classes (< 16 years and \geq 16 years in painting or carpetlaying), no dose-response relationship was found.

Discussion

The result of this study indicates that men exposed to solvents have an increased risk of being prematurely pensioned due to neuroses, but not due to alcoholism or other neuropsychiatric disorders.

This result is in concordance with those of Swedish and the Danish case-referent studies (2, 8). In the Danish study neurotic disorders in particular were pronounced among individuals exposed to solvents.

Occupational health care and diagnostics of occupational diseases are quite advanced in Finland. However, work-related disorders which are mainly manifest as disturbances in affective-emotional reactions do not necessarily become diagnosed as occupational diseases. According to the data of The Finnish Register of Occupational Diseases only one painter in this material had a verified occupational disease due to solvent exposure.

In the present study the scrutiny of the etiology of the neuropsychiatric disorders was based on register data only, and therefore the data are subject to some nonspecificity and inaccuracy. The occupation reported by the pension applicants themselves was used as the indicator of solvent exposure. Obviously this

indicator is a good one for painters and carpetlayers, but it ignores all other workers who have been exposed to solvents during their work life. This circumstance probably weakened the associations discovered in our study.

An indicator based on occupation reveals those workers who have had a long-term and distinct exposure to solvents. Certainly also carpenters and laborers who work from time to time with painters and carpetlayers in the same workspaces become exposed to solvents. Evidently their exposure levels are in general much lower. This view was supported by a questionnaire survey undertaken among the cases and the referents to investigate the possible effects of those work-related psychosocial stress factors or neurotoxic exposures which could not be taken into account in the present study.

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