Association between male parenthood and self reported work impairment (n = 247)

		Male parenthood	
		Yes	No
Work impairment	Yes	50	21
	No	95	81
Prevalence or work impairment		34.5%	20.6%

the magnitude of the association, which compares with that reported by Finkelstein. The table shows the data for 247 male workers with a known parental status. The odds ratio obtained for parenthood in the multivariate logistic regression including age, smoking, work satisfaction (boredom), seniority at the task, and stressful life events was 1.6 (95% confidence interval 1.1–2.1).

Finkelstein suggested that back problems could occur more frequently among male parents due to parenting and recreational activities carried out with children. We would like to broaden the interpretation of that result to the work place as well. The work impairment that was reported by most workers in our study was limited to being bothered by back pain in doing the regular job and did not involve absenteeism. We could argue that the association between male parenthood and back problems could be confounded by other factors associated with being a father such as being less physically active in sports, being heavier, bringing to work family preoccupations as an additional source of stress, and even occupying different types of jobs that would contribute to back problems (maybe more sedentary in nature).

The corroboration of an association between male parenthood and back problems in two different studies re-enforces Finkelstein's recommendation of the importance of assessing parenthood (male or female) in epidemiological studies of back pain. The specific search for the "why" of such association might open new avenues for prevention.

MICHEL ROSSIGNOL

Center for Clinical Epidemiology and Community Studies, McGill University, 3755 Cote Ste-Catherine, Suite A-131, Montreal, Qc, Canada H3T 1E2

1 Finkelstein MM. Back pain and parenthood. *Occup Environ Med* 1995;52:51–3.

2 Rossignol M, Lortie M, Ledoux E. Comparison of spinal health indicators in predicting spinal status in a 1-year longitudinal study. *Spine* 1993;18:54–60.

Author's reply—I thank Rossignol for his comments, and apologise for having overlooked his paper on aircraft assemblers. His remarks highlight again the complex interaction between back pain and workplace and non-workplace factors. As there is a financial incentive to attribute health problems to the workplace, sorting out the various factors will be very difficult.

MURRAY FINKELSTEIN

Ontario Ministry of Labour, Health and Safety Studies Unit, 400 University Avenue, 7th Floor, Toronto, Ontario M7A 1T7, Canada

Preliminary experimental findings using intraperitoneal assays to determine carcinogenic potential of man made mineral fibres: relevance to recent proposals for classification testing

Editor—For many years the potential of different mineral fibre types to induce mesothelioma has been studied with intraperitoneal (IP) injection as a route of administration to rats. Many studies have been conducted in which man made mineral fibres have been reported to cause tumours in the peritoneal cavity, in particular, mesotheliomas.¹ As a result of the belief that inhalation may not provide an adequately sensitive assay for the carcinogenicity of man made fibres, a decision has been made in Germany for the formal classification of fibres based on the results of IP tests.² The proposed classification of fibres involves two stages: the calculation of a "carcinogenicity index" (Ki) based on chemical composition of the fibres combined with (if available) biological data from IP injection studies as follows:

if a negative result in IP test at 5×10^9 fibres, no classification: if positive then classification "possibly carcinogenic" (category 3)

if a negative result in IP test at 1×10^9 fibres, classification "possibly carcinogenic" (category 3)

if a positive result in IP test at $< 1 \times 10^9$ fibres, classification "probably carcinogenic" (category 2)

The definition of a fibre for the purposes of this test would be that given by the World Health Organisation (WHO) for measurement purposes, namely length $> 5 \mu\text{m}$, diameter $< 3 \mu\text{m}$, aspect ratio > 3 . Also, the fibres to be assessed should have size distributions typical of those found occupationally—that is, geometric mean diameters $0.6\text{--}2.0 \mu\text{m}$; geometric mean lengths $14\text{--}50 \mu\text{m}$.

In a recent series of studies, we investigated the carcinogenic potential of various fibre types after IP injection. Two studies have been conducted, in which the potential of glass fibres (MMVF11) and stonewool fibres (Rockwool D6) to cause mesothelioma has been investigated. One study (study II) used fibres with lengths and diameters typical of those found in the workplace.³ In our first study (study I) the fibres were somewhat shorter. Data were obtained on injection samples by counting and sizing with phase contrast optical microscopy and an image analysis system. In the first study, one injection was sufficient to give the required dose. In the second, four injections were performed on each animal. Table 1 shows the total mass

injected, estimated total number of fibres injected, the number of WHO fibres, and the median length of the injected fibres.

If the fibres typical of those found occupationally (those used in study II) were to be used in an IP injection study for classification purposes as proposed,² an IP injection study at a dose of 5×10^9 WHO fibres, would need to be negative. For such studies the following masses would be required:

glass fibre (MMVF11)	5300 mg
stonewool fibre (D6)	3400 mg

Under our current project licence required by the United Kingdom Animals (Scientific Procedures) Act (1986), we are restricted to a maximum of 45 mg for a single IP injection of fibres or four weekly injections of < 45 mg. Even if this limit were extended to allow an infinite number of weekly injections, the above masses would require in excess of 75 weeks to perform the injections.

We have found from peritoneal lavage studies, that the volume of the free space in the peritoneal cavity of a rat is about 10 ml in 10–12 week old animals, and would be lower in younger animals. Given that density of these fibre types is about 2.3 g cm^{-3} , the minimum volume which 5300 mg could occupy is 2.3 cm^3 or one quarter of the available free space in the peritoneal cavity. So even if the animals could be injected with this mass of material and survive, a significant fraction of the peritoneal free space would be filled with fibres.

Studies to determine the maximum mass that a rat could be injected with and survive have not been conducted, but I am certain that animals would not survive injection of the above masses. Even at the masses used in our studies (< 200 mg), we have seen significantly reduced life spans in animals that did not develop tumours, suggesting that the maximum tolerated dose for IP injection has been exceeded. The proposed regimen for testing fibres with IP injection would therefore not seem to be practical.

Our studies have also shown information on the sensitivity of the proposed IP test to fibre length. Table 2 shows for both studies, the doses given in terms of mass and fibre number, and the incidences of mesothelioma occurring in the animals. Results from studies on similar materials by Roller and Pott are also given for comparison and were obtained by personal communication (1994).

For the stonewool fibre types, the three groups injected with longer fibres showed a similar response irrespective of dose, suggesting that the maximum incidence had been achieved in all of these experiments. When shorter fibres were injected, even at a relatively high dose, the incidence of

Table 1 Injection data from animals injected with MMVF11 and D6 fibres

Material	Total mass of injection (mg)	Total fibres injected ($\times 10^9$)	WHO fibres injected ($\times 10^9$)	Median length (μm)	Median diameter (μm)	Geometric mean diameter (μm)
Study I:						
MMVF 11	52	11.4	7.5	6.86	0.97	0.89
D6	36	12.0	8.8	7.84	0.87	0.80
Study II:						
MMVF 11	167	1.88	1.57	24.9	1.39	1.39
D6	172	3.05	2.53	20.1	1.50	1.57