be entirely due to the association between age and the lifetime odds of having performed ripout.

Asbestos exposure (which was modelled as the number of years of exposure) was treated differently from fibreglass exposure (ever/never had a high exposure) in the multiple logistic regression analyses. The tables and text indicate that a fibreglass exposure index based on either the adjusted years of fibreglass exposure or none/moderate/high fibreglass exposure would not have indicated any association between fibreglass exposure and chronic bronchitis.

The median duration of exposure in the "high level" fibreglass group is zero years, and 75% of this group had less than one year of experience at the "high level". It is not biologically plausible that such a fleeting exposure is responsible for symptoms of chronic bronchitis.

Work history and exposure modelling are not adequately considered. It is questioned whether the exposure models are truly able to distinguish qualitatively and/or quantitatively between the exposures of asbestos, welding, and fibreglass, given the high degree of correlation among them. No attempt was made to validate the self-reported exposures (which are open to recall bias) nor to validate the models of fibreglass and asbestos exposure. More should have been done to validate the exposure modelling assumptions because the paper’s conclusions are based on these assumptions (see industrial hygiene comments later).

The overall design of the survey raises important questions about the potential impact of these limitations on the study. This includes the representativeness of the results and the validity of generalising these results beyond the sample.

The survey's results are based on less than 40% of those eligible and invited to participate. It relied on data from a previous medical screening in which only 47% of those invited agreed to participate (12 454 of 26 329 sheet metal workers). Of this, 407 (41%) of the workers were selected from United States Sheet Metal and Air Conditioning National Association locals in the southeast sun belt and west coast states. Only 333 (82%) of these 407 completed the interview.

Unanswered, yet most important questions remain. How did survey eligibility criteria affect results? Are there health related selection factors that influenced eligibility—for example, worked in the sheet metal shop for at least 70% of his working career, did removal for at least 40% of his working career, or welding for less than 20% of his working career? What sort of self selection factors over time in eventually impact eligibility, exposure, or health?

An important industrial hygiene consideration and a major issue in this study is the assignment of "high", "moderate", or "low" concentration designations. No actual airborne fibre measurements were made of the occupational tasks. Rather, exposures were derived from several published reports. Also, the questionnaire only obtained "average percentage times" spent working in four broad areas of sheet metal work—namely, shop work, welding, job site installation, and ripout. Unless the exposure history is stated in terms of the usual work tasks, airborne concentrations, duration of exposure, and other airborne exposure at the work site, any analysis will be of very limited value.

For example, the designation of "high" exposure was given to any fibreglass ripout operation. There were no ripout exposure concentration values referenced. One can not draw analogies from asbestos ripout operations with regard to the amount of fibre fly. A limited amount of sampling data (there is not that much fibreglass torn off) shows that fibreglass ceiling board ripout resulted in airborne fibre exposures with an average of 0.29 fibres/ml for all fibres, using the NIOSH 7400A method (which would be somewhat similar, but not identical to the method used by Balzer et al. and Fowler et al.).

When the 7400B method (respirable fibres) was used, total fibre concentration was 0.14 fibres/ml, with further analysis revealing only 0.014 fibres/ml of respirable glass fibres. For pipe insulation ripout the airborne exposure concentrations were 0.126, and 0.046 fibres/ml for all respirable fibres and respirable glass fibres, respectively. The fibre concentrations reported by Balzer, Copper, and Fowler, as well as being total fibre counts, did not differen-
tially separate glass and fibrous materials. 1 Further, the average airborne fibre diameters were well above the respirable range, suggesting that respirable fibre exposure would be lower.

Using NIOSH 7400B analytical methods, airborne fibres were based on fibre concentrations for a wide variety of fabrication and installation operations including pipe insulation, range assembly, duct assembly, duct board installation, water heater assembly, and flex duct assembly ranged from 0.006 fibres/ml (duct board assembly) to 0.087 fibres/ml (general fabrication) for all fibres and 0.002 (duct board installation) to 0.071 fibres/ml (general fabrication) for glass fibres. In no instance did the 95th percentile individual concentration exceed 0.12 fibres/ml. These respirable fibreglass exposure concentrations are similar to average concentrations recently noted: insulation wool manufacture (all fibres, 0.03 fibre/μm2 and all fibres, 0.05 fibres/μm2); Asbestos exposures are failures that confronted and confounded Engholm, and Von Schmalensee and Engholm et al.

Based on the data presented, the paper's conclusion that high intensity exposure to fibreglass causes chronic bronchitis is unwarranted.


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