

COMMENTARY

Considerations of Specificity in Assessing the Relationship Between Asbestos and Cancer

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In his paper "Changing Attitudes and Opinions Regarding Asbestos and Cancer 1934-1965," Dr. Enterline [1991] discussed the timing of when scientists determined that asbestos was a cause of cancer. He concluded that, in Germany, the issue was decided in 1943, and that in the United States, a consensus was reached in 1964. Taken at face value, Dr. Enterline's conclusion can easily be misinterpreted. Although the statement "asbestos is a cause of cancer" is certainly true under certain circumstances, this statement lacks specificity. Most of us would agree that we have known for a long time that "chemicals can cause cancer," but this statement is not very informative. A causative statement should be specific in terms of both exposure and health outcome. In the case of asbestos, the specifics that we need with regard to exposure are type of fiber, length of fiber, fiber concentration, duration of exposure and type of industry. With regard to health outcome, the least we need to specify are the cancer sites.

In assessing causation in chronic diseases, the most systematic approach is to apply the criteria set forth by Hill [1965]: strength of association, specificity of association, consistency of association, dose-response relationship, and biological plausibility. The same set of criteria was also used by the Surgeon General in assessing the relationship between cigarette smoking and cancer [U.S. Department of Health, Education and Welfare, 1964]. The International Agency for Research on Cancer also used a similar set of criteria in carcinogenicity classification of substances [see, for example, IARC, 1989]. In the specific case of asbestos, Drs. Selikoff and Lee [1978] applied a similar set of criteria in their monograph. It appears that it would have been more appropriate for Dr. Enterline to apply similar criteria to the assessment of the timing of the consensus on carcinogenicity of asbestos.

In his assessment, Dr. Enterline also relied on clinical reports. Although clinical or case reports are useful suggestions for epidemiologic research, they are not in

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themselves proofs of causation, and they cannot replace proper epidemiologic studies. Although in hindsight one can point to the first case report as an indication of causation, there are numerous examples in which subsequent epidemiologic studies refute the causative suggestions made by earlier case reports [Wong, 1988].

Asbestos is a collective term for the metamorphic fibrous mineral silicates of the serpentine and amphibole groups. They have not only different physical and chemical properties, but also different fibrogenic and carcinogenic properties. Whether asbestos fibers are carcinogenic or not depends to a large extent on the type of fiber as well as the length of the fiber. In addition, the type of industry or industrial process and the manner of exposure are all important factors in determining carcinogenic potential.

With regard to the issue of asbestos exposure and mesothelioma, contrary to Dr. Enterline's conclusion, there are still many unresolved questions. Scientists are still debating whether chrysotile can cause mesothelioma. The debate is evident from the lively exchanges published recently in the *American Journal of Industrial Medicine* [Vol. 14, pp. 205-249]. If we cannot agree on the specific issue of chrysotile and mesothelioma today, certainly we could not have arrived at a decision or consensus in 1964. Thus, regardless of whether we agree with Dr. Enterline's assessment of the timing of the consensus, the consensus itself needs to be carefully specified.

Another example of the danger in oversimplification is the issue of lung cancer risk among garage mechanics. Although garage mechanics are exposed to brake lining dust, which contains chrysotile asbestos, their exposure is extremely low. The typical 8-hr time-weighted average fiber concentration among garage mechanics is <0.05 fiber/cc [Wong, 1992]. Given this low-level exposure, we would not expect to see any increase in lung cancer among garage mechanics. This is supported by several epidemiologic studies of lung cancer among garage mechanics.

An epidemiologic study of 8,486 bus garage workers in London indicated that the lung cancer standardized mortality ratio (SMR) in these workers was 0.88 (102 observed vs. 116.5 expected), compared to the general population in the London area [Rushton et al., 1983]. Among a subgroup of 2,313 bus mechanics, the lung cancer SMR was 0.92, based on 22 observed and 23.9 expected deaths [Rushton, 1987]. Thus, these bus mechanics had a lung cancer risk similar to that of the general population.

In another large-scale cohort study, cancer mortality of 21,800 auto mechanics was compared to that of 51,747 unexposed skilled workers in Denmark [Hansen, 1989]. Among the auto mechanics, 41 lung cancer deaths were observed, compared to 40.7 expected. The corresponding SMR was 1.01, indicating no elevated lung cancer risk among these auto mechanics.

In a third cohort study of 695 bus garage workers in Stockholm, 17 lung cancer deaths were observed, compared to 14.8 expected, based on the Stockholm general population [Gustavsson et al., 1990]. The corresponding lung cancer SMR of 1.15 was not statistically significant. More importantly, lung cancer mortality was analyzed with respect to cumulative asbestos exposure in the study, and no relationship was found. The authors concluded that "no effect from exposure to asbestos was found."

The results of these three cohort mortality studies are summarized in Table I. A metaanalysis of these data indicates that the summary lung cancer SMR based on all three studies is 1.01, based on 80 observed lung cancer deaths. This finding of a lack of increased lung cancer risk among garage mechanics is further supported by a recent case-control study.

In a large case-control study of lung cancer in France, occupational exposures

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TABLE I. Metaanalysis of Lung Cancer Mortality in Garage Mechanics*

Study	Location	Study size	Observed	Expected	SMR
Rushton [1987]	London	2,313	22	23.9	0.92
Gustavsson [1990]	Stockholm	695	17	14.8	1.15
Hansen [1989]	Denmark	21,800	41	40.7	1.01
Total		24,808	80	79.4	1.01

*Lung cancer meta-SMR = 1.01; 95% confidence limits = 0.80, 1.26.

of 1,625 histologically confirmed cases were investigated [Benhamou et al., 1988]. In addition to occupations, data on residence, smoking, and drinking were also analyzed. After adjusting for cigarette smoking, the relative risk of lung cancer of "motor vehicle mechanics" was 1.06, based on 65 cases. Thus, this large epidemiologic study indicated that auto mechanics had a lung cancer risk similar to that of the general population.

In summary, these epidemiologic studies clearly indicate that there are no data to support or even to suggest an association of lung cancer risk and exposure to brake lining dust. In fact, these studies provide strong evidence that garage mechanics' lung cancer risk is similar to that of the general population. This observation underscores the importance of specifying the particular industry in assessing the relationship between asbestos and cancer.

In his article, Dr. Enterline [1991] has provided an interesting account of the historical development of our knowledge on asbestos and cancer. Unfortunately, Dr. Enterline might have oversimplified the issue. As indicated by the examples given above, there are still unresolved issues. Furthermore, in assessing the relationship between asbestos and cancer, blanket statements can be misleading and incorrect. Specificity is a vital ingredient in any cancer risk assessment.

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