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Case Studies in Environmental Medicine

Asbestos Toxicity

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Who's At Risk

In the past, asbestos exposure was associated mainly with mining and milling of the raw material and with workers engaged in product manufacture. Because industrial use has decreased over the last 40 years, these occupational exposures have declined. Today, most exposures occur during repair, renovation, removal, and maintenance of asbestos that was installed years ago. The number of new exposures to the general population from in-place asbestos, however, may be greater in number than the exposures experienced by all earlier workers combined.

In detailed interviews in industrialized countries, 20% to 40% of adult men report some past occupations and jobs that may have entailed asbestos exposure at work (International Expert Meeting on Asbestos, Asbestosis, and Cancer 1997). An estimated 27 million workers in the United States were exposed to aerosolized asbestos fibers between 1940 and 1979. Over 30 million tons of asbestos have been mined, processed, and applied in the United States since the early 1900s (Kamp and Weitzman 1999). In industrialized countries, about 10,000 mesotheliomas and 20,000 asbestos-induced lung cancers are estimated to occur annually in a population of about 800 million people (International Expert Meeting on Asbestos, Asbestosis, and Cancer 1997).

- Workers in the construction trades are most heavily exposed to asbestos.

The most heavily exposed people in the United States are those in the construction trades. In 1988, there were 6,300,000 active construction workers in the United States. Because most asbestos has been used in construction, and two-thirds of asbestos produced is still used in this trade, risk to these workers can be considerable. Carpenters, utility workers, electricians, pipefitters, steel mill workers, sheet metal workers, boiler makers, and laborers are at risk for exposure of asbestos through construction materials; insulation coverings of pipes, boilers, and industrial furnaces; and other sources. Mechanics working with brake and transmission products also can be exposed to asbestos.

- Spouses and family members can be exposed through asbestos dust on workers' skin and work clothing.

Secondary exposure occurs when fibers released to the air are inhaled by persons not directly handling asbestos. For example, 4 to 5 million shipyard workers were exposed when a relatively small number of insulation workers applied asbestos to ships' pipes and hulls. Domestic and environmental asbestos exposures can also occur indirectly. Asbestos-related diseases have occurred in family members whose only contact was dust from an exposed worker's clothing. In some circumstances, exposures in household members might approach occupational levels. Similar diseases were also found in persons who grew up within one-half mile of an asbestos factory.

People in contact with work clothes of asbestos workers or with asbestos-containing household products have developed pleural abnormalities. An asbestosis prevalence of 11% in wives, 8% in sons, and 2% in daughters was reported in families of asbestos-exposed shipyard workers. Low exposures from work-related, household, and natural sources can induce pleural plaques. For diffuse, pleural thickening, higher exposure levels might be required (International Expert Meeting on Asbestos, Asbestosis, and Cancer 1997).

According to Hillerdahl (1999), no known truly unexposed group exists in the world. No proof of a threshold value exists—that is, a minimum lower limit below which asbestos fibers cannot cause a tumor—and thus it is plausible that even such low exposure can cause mesothelioma (even if the risk is extremely low). However, on the basis of studies of nonoccupational exposures, it seems probable that occasional high-level exposure situations are those that are most harmful and should be avoided. The cumulative risk of background exposures is probably minor, and these concentrations cannot be reduced. Any source of pollution by asbestos that releases significant amounts of fibers should be eliminated, using correct equipment and techniques, as soon as it is discovered. If the asbestos is well contained and not disturbed, it is usually better to leave it in place. In many cases, encapsulation is better than removal.

- Cigarette smoke increases the risk of asbestos-associated lung cancer.

Cigarette smoking and exposure to other carcinogens greatly increase the risk of asbestos-associated lung cancer. A comparison of the experiences of 17,800 asbestos insulation workers with matched controls showed that asbestos workers who did not smoke suffered five times the number of lung cancer deaths than did controls who neither smoked nor worked with asbestos (55 deaths per 100,000 person-years for asbestos workers who did not smoke compared to 11 deaths per 100,000 person-years for controls who were neither asbestos workers nor smokers). Persons who smoked but did not work with asbestos had a death rate of 122 per 100,000 person-years; and among persons with both exposures (asbestos and cigarette smoking), 601 deaths occurred per 100,000 person-years. Evidence shows that cigarette smoking in asbestos workers is also associated with increased risk of cancer of the esophagus, oropharynx and buccal cavity,

and larynx. However, other cancers that might occur in excess in asbestos-exposed persons, such as those of the stomach, colon-rectum, and kidney, do not appear to be synergistically affected by smoking and asbestos exposure, because smoking and nonsmoking asbestos workers suffer equal incidences of these health effects. Smoking appears to have no influence on the risk of mesothelioma. Although cancer, when established, can be irreversible, cancer risk due to smoking is reversible. Data indicate that risk diminishes when smoking ceases.

There might be genetic polymorphisms in various detoxifying enzymes (e.g., for reactive electrophilic molecules such as reactive oxygen radicals or nitrous oxide) that increase susceptibility to asbestos disease (Agency for Toxic Substances and Disease Registry 2001).

Challenge

(1) On questioning the mother, you learn that the father of the boy described in the case study is a master carpenter who specializes in restoring Victorian-style homes. What are the potential sources of asbestos exposure for the child?

(2) The spouse of the mother's cousin is reportedly in good health. Should she be screened for asbestos-related disease? Explain.

For a printer-friendly version of the **Asbestos Toxicity Case Study**, download the [PDF version](#).

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