

Critical Review of Epidemiologic Studies Related to Ingested Asbestos

by Gary M. Marsh*

Thirteen epidemiologic studies of ingested asbestos conducted in five areas of the United States and Canada were reviewed and evaluated for the definitiveness and applicability regarding the development of ambient water quality standards. One or more studies found male or female associations between asbestos in water supplies and cancer mortality (or incidence) due to neoplasms of the esophagus, stomach, small intestine, colon, rectum, gallbladder, pancreas, peritoneum, lungs, pleura, prostate, kidneys, brain, and thyroid, and also due to leukemia. Several methodologic weaknesses and limitations were found in each study, leading to the determination that no individual study or aggregation of studies exist that would establish risk levels from ingested asbestos. A binomial probability analysis of the eight independent studies suggested that, while the level of male-female agreement was generally low, the number of observed positive associations in males and females for neoplasms of the esophagus, stomach, pancreas, and prostate was unlikely to have been generated by chance factors alone, and thus, may have a biological basis related to ingested asbestos. Cancers of the small intestine and leukemia were implicated to a lesser degree in this analysis. The patterns of integrated findings for most gastrointestinal cancers were somewhat consistent with patterns observed among asbestos-exposed occupational groups, whereas the patterns found for pancreatic cancer, kidney cancer, and leukemia were not consistent. It was recommended that the integrated ecologic data to date be used to generate a rough priority of specific etiologic hypotheses that should be tested in the original settings or in independent study populations using studies designed at the more definitive individual level, such as case-control studies. The Bay Area (California) and Puget Sound (Washington) were deemed to be the existing study areas most suitable for future research.

Introduction

In 1982, the U.S. Environmental Protection Agency commissioned a critical review of the major epidemiologic studies that were germane to the question of possible adverse health effects caused by ingested asbestos. Thirteen published and unpublished studies conducted in five areas of the United States and Canada were included in the review (1-13). This paper presents the major findings and salient points of the more detailed review found elsewhere (14).

Background

The genesis of all of the studies included in this review was the 1973 discovery of large amounts of amphibole asbestos fibers in Lake Superior, the

source of municipal water for Duluth, Minnesota, and five small communities on the lake shore. The first epidemiologic study to appear after this discovery was conducted in Duluth by Mason et al. in 1974 (1). Mason's study of 1950-1969 cancer mortality rates was followed by two studies of cancer incidence rates in Duluth, the first in 1976 by Levy et al. (2) and the second in 1981 by Sigurdson et al. (3). The two Connecticut studies of Harrington et al. in 1978 (4) and Meigs et al. in 1980 (5) were prompted by the possibility of studying reliable cancer incidence data over a 35-year period through the Connecticut Tumor Registry and linking these data with information collected on asbestos-cement pipe studies done by the U.S. EPA. In Canada, the mortality studies of Wigle in 1977 (6) and Toft et al. in 1981 (7) were induced by the extent of the asbestos mining done in Quebec and by environmental surveys that revealed high concentrations of asbestos fibers in the drinking water supplies of certain cities. The

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