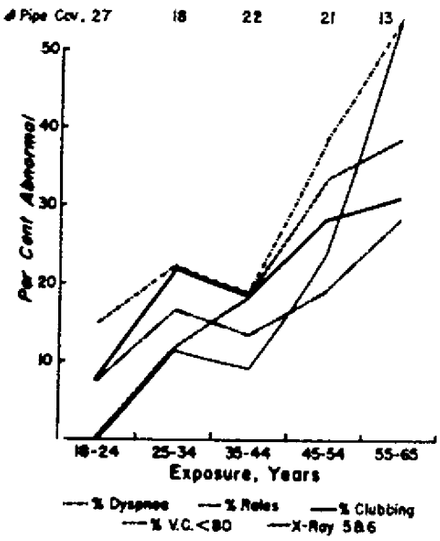

Figure 4. Increases with Duration of Exposure in Prevalence of Dyspnea, Rales, Clubbed Fingers, Reduced Vital Capacity and Roentgenologic Abnormalities.

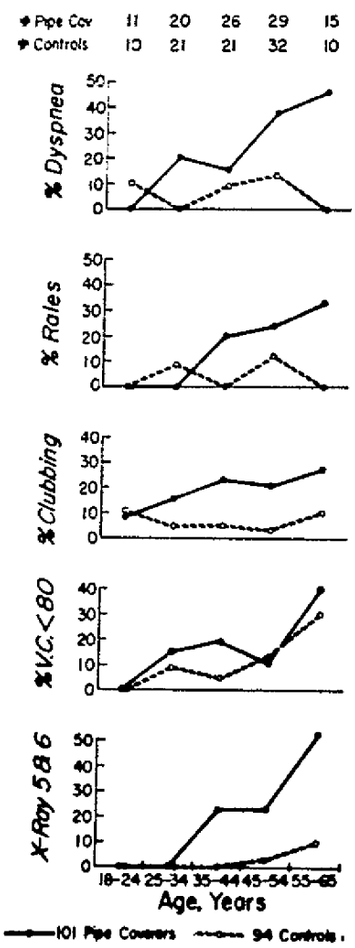

Figure 5. Higher Prevalences of Clinical Abnormalities Seen in Older Pipe Coverers but Not in Older Controls.

Since the association between age and cumulative years of exposure (Fig. 4) was high (r equal to 0.7, p less than 0.001), the importance of aging in relation to these abnormalities was reviewed in the controls, no clear association with age was found except in vital capacity.

detailed pulmonary-function studies, by a group of internists not associated with this study. In the eight who consented, no illness other than asbestosis was discovered to account for the signs and symptoms. Two of these men have since died, and both had severe asbestosis. Of the remaining three who refused detailed examination, two have died; autopsy in one showed asbestosis and cor pulmonale, and the other died of bronchopneumonia.

The accuracy of a "negative" diagnosis is much more difficult to assess. Only one worker so classified has died. His history, physical examination and ventilatory-function studies had all been normal at the time of this survey, and his chest roentgenogram showed slight asbestosis (code 4). When he died of peritoneal mesothelioma, the lungs showed minimal chronic interstitial pneumonitis. Conclusions should not be drawn from this single case, but the prevalences reported here probably are too low. Our subsequent surveys were designed to investigate this possibility.

What is the likelihood that other disease caused the findings that we attributed to asbestosis? Medical-record review, the respiratory questionnaire, physical examination, skin testing, sputum examination and roentgenograms did not uncover any excess cardiac disease, tuberculosis or other pulmonary disease. There was no significant difference in smoking habits in the entire population of pipe coverers and controls.

Asbestosis and Dust Exposure

The concept of a dose-response relation was introduced by Merewether and Price in 1930,[19] but the first information useful for calculating threshold limit values came from Dreessen et al. in 1938.[21] They found clear-cut asbestosis among those exposed to dust concentrations exceeding 5 mppcf, and none at lower concentrations. Therefore, tentatively, they regarded 5 mppcf as a threshold value.[21] These observations were confirmed by Vigliani.[22] In retrospect, the choice of 5 mppcf, on the basis of the data then available, was open to question; in the dust counts in the textile mills no distinction was made between cotton and asbestos fibers. Furthermore, among those who were exposed at or just above this threshold (that is, 5.0 to 9.9 mppcf), 13 of 19 were considered to have asbestosis after 10 years, and six of 37 after only five years. In relation to the dose-times-time relation, over ½ the workers exposed to 100 mppcf-years had asbestosis. Dividing 100 mppcf-years by the recommended threshold