

June 6, 1967

TO: F. J. Solon, Jr..
K. V. Lindell
H. M. Jackson

Handwritten: A...
H.F.R. Jones

RE: Asbestos/Health

Attached are the following, in connection with the above subject:

1. Evaluation sheet for the AMA paper, by Drs. Selikoff, Hammond, et al. The paper itself was previously distributed to you.
2. Evaluation sheet (together with copies of the pages where asbestos is mentioned) of the paper presented by Dr. Hammond at the Annual Meeting in Cleveland, Ohio of the Air Pollution Control Association (June 14, 1967).

Handwritten: Bill
W. P. Raines

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Subject: General air pollution associated with disease and mortality.

Passing mention of asbestos dust. Of interest and importance.

Evaluation: Although this paper only touches on asbestos, it is of interest because the same author was co-author of a paper on asbestos and smoking presented at the American Medical Association meeting, five days later. The data are not identical. In this earlier paper the details on smoking and the mortality rate from lung cancer among asbestos workers are vague. However, more emphasis is put on mesothelioma. "Exposure to asbestos may be the principal cause of mesothelioma of the pleura and mesothelioma of the peritoneum."

Author: Hammond, E. C.

Unpublished: Presented at the meeting of the Air Pollution Control Association, Cleveland, June 14, 1967.

Title: "Epidemiological Evidence on the Effects of Air Pollution"

Summary: General air pollution usually consists of contamination from a number of different agents. This makes the problem of identifying specific pathogenic components, and estimating their effects, very difficult.

"While we do not know the relative importance of various components of cigarette smoke, it is clear that avoidance of exposure to cigarette smoke eliminates risk from this personal type of air pollution. Likewise, while we do not yet know the importance of various components of general air pollution, it would appear to be wise to reduce general air pollution of all types in so far as possible."

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Epidemiological Evidence on
The Effects of Air Pollution

by

E. Cuyler Hammond, Sc. D.

From

The Department of Epidemiology and Statistics
American Cancer Society, Inc.
New York City

Annual Meeting
Paper No. 67 - 78

60th Annual Meeting
Air Pollution Control Association
Sheraton - Cleveland Hotel
Cleveland, Ohio

June 14, 1967

2 p.m. Session

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the absence of air pollution of one variety or another. Some of the occupational exposures which lead to a high incidence rate of this disease (e.g. radon gas, dust containing nickel and dust containing chromates) are so well known that I do not need to belabor the point. ^{3,4)} Epidemiological evidence indicates that even a relatively low degree of occupational exposure to asbestos dust (i.e. the degree of exposure incurred by insulation workers) leads to an extremely high death rate from lung cancer, a death rate in the order of magnitude of 7 to 10 times that of the general male population. ^{5,6)}

Evidence indicting personal air pollution in the form of cigarette smoking as the principal cause of lung cancer in the general population is now so voluminous that I can only touch upon it. ^{7,8,9)} Extremely large prospective epidemiological studies have shown that lung cancer death rates are very low among people who have never smoked, greatly higher among cigarette smokers, increase with amount of cigarette smoking, increase with the degree to which the smoke is inhaled, and are higher among smokers who take up the habit at a young age than among those who take up the habit later in life. ^{10,11,12,13)} This has been paralleled by evidence from necropsy studies of retrospective epidemiological design. ^{14,15)} These have shown an extraordinarily high relationship between cigarette smoking and atypical changes in the nuclei of bronchial epithelial cells up to and including carcinoma-in-situ. Cigarette smoke condensates can cause cancer if applied to the skin of experimental animals ^{16,17)} and recently carcinoma-in-situ has been produced in the bronchial tubes of dogs by arranging for them to smoke cigarettes. ¹⁸⁾

The combination of occupational exposure and cigarette smoking can lead to a tremendously increased risk of lung cancer. Consider the following figures. In a prospective study of asbestos workers, 458 men were traced from

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January 1, 1958 through December 31, 1962 (there being 2,011 man-years of exposure to risk) and 18 of them died of lung cancer, a lung cancer death rate of 8.95 per 1,000 man-years.⁵⁾ A large proportion of the asbestos workers were cigarette smokers, and this high rate of lung cancer undoubtedly resulted from the combined effects of the two air pollutants (occupational and personal).⁶⁾ In the large prospective study mentioned earlier, there were 95,849 men who never smoked regularly traced from late 1959 and early 1960 through September 30, 1963 (there being 358,254 man-years of exposure to risk) and 49 of them died of lung cancer, a lung cancer death rate of only 0.14 per 1,000 man-years.¹³⁾ It should be noted the two groups of subjects were in the same age range (35 to over 80) and their average ages differed by only about one year.

The lung cancer death rate of persons who never smoked regularly (men and women combined) increases with age from about 0.02 per 1,000 per year in age group 40 to 44 up to about 0.55 per 1,000 per year in age group 80 to 84.¹³⁾ These death rates, very low as they are, must be attributed mainly to factors other than smoking (I say "mainly" since the "never smoked regularly" category includes people who smoke occasionally). Surely, some portion of the rate must be attributed to occupational air pollution. The fact that the lung cancer death rate of non-smokers is somewhat higher among men than among women is consistent with this interpretation.¹³⁾ Furthermore, it may well be that some portion of the rate is attributable to what I have called localized air pollution. The residue may perhaps be due to general air pollution. However, this residue is so very small that in my opinion, it would be virtually impossible to determine whether or not it is due to general air pollution.

Supplementary evidence on this comes from necropsy studies.^{14,15)} In these studies, carcinoma-in-situ of the bronchial tubes has not been found in

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Both among non-smokers with occupational exposure and among non-smokers without occupational exposure, the rural percentages were a little higher than the metropolitan percentages (but in absolute terms, these differences in percentages were very small). This was also generally the case among cigarette smokers (age and amount of smoking being taken into consideration).

These findings are consistent with other evidence indicating a high degree of relationship between cigarette smoking and emphysema. They suggest that occupational exposure to dust, fumes and vapors increases the risk or hastens the development of emphysema in cigarette smokers. In any event, the findings indicate the necessity of taking occupational exposures as well as cigarette smoking and age into consideration when attempting to determine whether general air pollution has an influence on the occurrence of chronic respiratory disease.

Pneumoconiosis and Mesothelioma

Occupational air pollution of various types capable of causing silicosis, asbestosis, and other types of pneumoconiosis are so well known that I need not discuss the problem here. It is possible that localized air pollution from the same agents in the near vicinity of some mines or factories may perhaps be sufficiently great as to produce pneumoconiosis in some individuals.

Exposure to asbestos may be the principal cause of mesothelioma of the pleura and mesothelioma of the peritoneum. ^{6, 32)} The evidence indicates that the inhalation of asbestos dust can cause pleural mesothelioma; it is not so clear whether the inhalation of asbestos dust or only the ingestion of asbestos can cause peritoneal mesothelioma.

As would be expected under these circumstances, mesothelioma occurs most frequently among workers occupationally exposed to asbestos dust. ⁶⁾

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However, there is evidence that some cases of the disease result from non-occupational exposure of persons living in the vicinity of places where asbestos is being worked. ³³⁾ Furthermore, it is not impossible that asbestos fibers of microscopic size are so widely distributed by the wind and come from so many different sources that they constitute an important component of general air pollution in some metropolitan areas. This is now being investigated.

Coronary Heart Disease

Cigarette smoking leads to an increase in death rates from a number of different diseases, so, within a given period of time more deaths occur among cigarette smokers than non-smokers (age and sex being taken into consideration). A large proportion of these excess deaths are accounted for by the fact that death rates from coronary heart disease are higher among cigarette smokers than among non-smokers and increase with amount of cigarette smoking. ^{10,13,35)}

Several different effects of cigarette smoking may jointly contribute to the high rates of incidence and death from coronary heart disease among cigarette smokers. For example, nicotine causes a temporary increase in heart rate and causes temporary constriction of peripheral arteries; carbon monoxide reduces the oxygen carrying capacity of the blood; and the effect of cigarette smoking on the lung parenchyma secondarily puts a strain upon the heart. ⁸⁾ An association has been found between degree of coronary atherosclerosis and cigarette smoking (although cigarette smoking is certainly not the major factor in the occurrence of this condition which is almost universal among American men). ³⁶⁾ Still another possible factor will be mentioned in a moment.

Extreme general air pollution also appears to lead to an increase in deaths

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Subject: Statistical study of mortality among insulating workers, presumably exposed to asbestos, who also smoke cigarettes. Important.

Evaluation: The evidence presented suggests that asbestos is a potent co-carcinogen for bronchial carcinoma, but, as the authors say "exposure to asbestos dust does not lead to an extremely high risk of lung cancer among non-smokers." Among the "asbestos workers" who smoked cigarettes lung cancer mortality was eight times as high as among smokers in the general population, 24 times as high as among non-smokers in the general population. Although there was no lung cancer among non-smoking asbestos workers, the authors conclude that the sample was too small to "prove that exposure to asbestos dust has no influence on the risk of lung cancer among non-smokers." Although more than 15 percent of the deaths were due to asbestosis uncomplicated by lung cancer, there are no data indicating whether the lung cancer deaths were complicated by concurrent asbestosis. That point may be important in view of Knox's assertion that the prevention of asbestosis is the basic factor in reducing lung cancer mortality among asbestos workers.

Authors: Selikoff, I. J., Hammond, E. C. and Churg, J.

Unpublished: Presented at the meeting of the American Medical Association, Atlantic City, June 19, 1967. Reported by the Associated Press.

Title: "Asbestos Exposure, Smoking and Neoplasia"

Summary: Study was conducted among 370 members of the Asbestos Workers Union over a period of 52 months. Among 283 smokers there were 78 deaths from all causes, 24 from lung cancer. Among 87 non-smokers there were seven deaths, none from lung cancer. Six smokers and one non-smoker died of mesothelioma.

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