

Table 5.—Observed and Expected Bronchogenic Carcinoma Deaths by Smoking Habits* for 370 Asbestos Workers

Smoking Habits	Observed Deaths	Expected Deaths
Never smoked regularly	0	0.05
History of pipe, cigar smoking only	0	0.13
History of regular cigarette smoking†	24	2.98
Total	24	3.16

*Based upon data in Table 2 and Table 4.

†Includes cigarette smokers who also smoked pipe or cigar.

Table 6.—Expected and Observed Deaths Among 632 Asbestos Workers Exposed to Asbestos Dust 20 years or Longer

	1943-1962	1963-1967	Total 1943-1967
Total deaths: all causes			
Expected	203.5	47.5	251
Observed	255	94	349
Total cancer: all sites			
Expected	36.5	8.6	45.1
Observed	95	49	144
Cancer of lung, trachea, pleura			
Expected	6.6	2.3	8.9
Observed	45	27	72
Cancer of stomach, colon, rectum			
Expected	9.4	1.8	11.2
Observed	29	8	37
Cancer all other sites combined			
Expected	20.5	4.5	25
Observed	21	14	35
Asbestosis			
Expected	0	0	0
Observed	12	15	27
All other causes			
Expected	167	38.9	205.9
Observed	148	30	178

into consideration. The results are summarized in Table 5 which shows the expected and observed number of lung cancer deaths in each of three smoking categories.

Taking smoking habits as well as age into consideration (Table 5) a total of 3.2 bronchogenic carcinoma deaths were expected whereas taking only age into consideration 2.3 deaths were expected from this cause (Table 3). Thus, perhaps one of the excess bronchogenic carcinoma deaths might be attributed to the fact that there appear to have been proportionally somewhat more cigarette smokers among the 370 subjects than among men of the same ages in the general population.

The following statements are based upon the data shown in Table 5. Twenty-four deaths from bronchogenic carcinoma occurred among the 370 subjects compared with only 3.16 expected, a ratio of about 7.6 to 1. This is slightly higher than found in our earlier study which indicated a ratio of 6.8 to 1 (not taking smoking habits into consideration). It should be noted in this connection that the 370 subjects in this study had been exposed to asbestos dust somewhat longer than the subjects of our previous study (the present 370 subjects are survivors as of Jan 1, 1963, of subjects in the previous study).

Of the subjects who never smoked regularly and those who smoked only pipes or cigars, none died of bronchogenic carcinoma whereas 0.18 of these were expected to die of lung cancer. This suggests that exposure to asbestos dust does not increase the risk of bronchogenic carcinoma among

men who never smoked cigarettes regularly. However, considering the small number of such subjects in this study, we only conclude that exposure to asbestos dust does not greatly increase the risk of bronchogenic carcinoma among men who never smoked cigarettes regularly.

Twenty-four of the men with a history of regular cigarette smoking died of bronchogenic carcinoma whereas only 2.98 were expected to die of it, a ratio of 8.05 to 1. From this it appears that exposure to asbestos dust greatly increases the risk of lung cancer among cigarette smokers.

Now we may ask how greatly is the risk of bronchogenic carcinoma increased by the combined effects of cigarette smoking and exposure to asbestos dust. To answer this question, we applied rates shown in Table 4 for nonasbestos workers who never smoked regularly to the number of subjects with a history of regular cigarette smoking as shown in Table 2. This indicated that only 0.26 of the subjects with a history of regular cigarette smoking would have been expected to die of bronchogenic carcinoma if they had never smoked regularly and had never been occupationally exposed to asbestos dust. Since 24 of them actually died of this cause, the ratio of observed to expected deaths is 92 to 1 (ie, 24 divided by 0.26=92). This appears to indicate that cigarette smoking plus occupational exposure to asbestos dust increases the risk of bronchogenic carcinoma by a factor in the order of magnitude of 92 to 1. It should be noted that this estimate does not take current amount of cigarette smoking into consideration.

Comparison With Earlier Findings.—As explained, we started with a cohort of 632 asbestos insulation workers, the entire membership of the union locals on Jan 1, 1943. We have now traced each man through April 30, 1967. Table 6 shows the observed and expected number of deaths for each of two periods (the first, 1943 to 1962, being previously reported¹) and for the entire period. In respect to respiratory cancer (lung, trachea, and pleura) and in respect to cancer of the stomach, colon, and rectum, the findings in the two periods are in close agreement.

Comment

The increased risk of neoplasia (mainly bronchogenic carcinoma and mesothelioma) among insulation workers reported here should be evaluated in the knowledge that these men have comparatively light exposure as asbestos trades go. Primarily employed in construction work, many of the materials they use contain little or no asbestos and others have only 5% to 15%. Conditions of work vary; these men often work outdoors unlike asbestos operators in factory work. Comparatively few dust-exposure surveys have been made in this trade but their results have generally been within the 5 million particles per cubic foot permissible limits currently accepted by the American Conference of Governmental Industrial Hygienists.^{9,10} Nor have