Table 3.—Observed and Expected Number of Deaths Among 370 Asbestos Workers During the 52-Month Period

Cause of Death	Observed Deaths	Expected Deaths*
Total, cancer (all sites)	49	8.6
Cancer of lung, pleura, bronchus, and trachea	27	2.3
Bronchogenic carcinoma	24	†
Pleural mesothelioma	3	‡
Peritoneal mesothelioma	7	‡
Cancer of stomach	3	0.6
Cancer of colon and rectum	5	1.2
Cancer of all other sites combined	7	4.5
Asbestosis	15	...
Heart and circulatory disease including stroke	22	28.5
All other causes of death	8	10.4
Total, all causes	94	47.5

*Based upon US mortality data disregarding smoking habits.
†United States data not available, but figure should be only slightly less than 2.3.
‡United States data not available, but these are rare causes of death in general population.

mesothelioma, three; peritoneal mesothelioma, seven; cancer of the colon, four; cancer of the rectum, one; cancer of the stomach, three; cancer of the pancreas, two; cancer of buccal cavity and pharynx, two; cancer of bladder, one; cancer of undetermined primary site, two; asbestosis, 15; cor pulmonale, one; cornary heart disease, 17; congestive heart failure, one; cerebral vascular lesion, two; aortic aneurysm, one; cirrhosis of the liver, three; bronchopneumonia, one; encephalopathy, one; acute pancreatitis, one; Wegener's granulomatosis, one; and accidental fall, one.

Expected Deaths.—For purposes of comparison, we wished to ascertain how many of the 370 subjects would have died during the 52-month period (Jan 1, 1963, to April 30, 1967) if their age-specific death rates had been exactly the same as for the general white male population of the United States. For this purpose, we made use of the United States 1964 life table for white males; this provided the most stable basis for comparison. It should be noted that for white males total death rates and death rates from respiratory cancer were slightly higher in the industrial states of New York and New Jersey than in the United States as a whole.[6,7] On the other hand, respiratory cancer death rates in white men aged 20 to 64 are reported to be a trifle lower than average among laborers, not elsewhere classified employed in construction work.[8]

From the life table we determined for each of the 370 men the probability of his dying within a period of 52 months, considering his age on Jan 1, 1963, and assuming that the life table probability applied to him. Summing these probabilities for the 370 men yielded an estimate of the "expected" number of deaths under the null hypothesis that the age-specific death rates of these asbestos workers are the same as for United States white males in general. The computation indicated that 47.5 deaths would have been expected.

Next, we wished to estimate the expected number of deaths from each of several causes. For this, we made use of the percentage distribution of deaths by cause of death among United States white males of various ages during the year 1964 as reported by the National Center for Health Statistics. These percentages were then standardized for age according to the age distribution at time of the 47.5 expected deaths. The results are shown in Table 3.

Expected vs Observed Deaths.—As shown in Table 3, there were 94 observed deaths (ie, 94 of the 370 asbestos workers died) as compared with 47.5 deaths expected on the basis of the age-specific death rates of all white males in the United States in 1964. Thus, there were 94 minus 47.5 = 46.5 excess deaths. The excess deaths were due to bronchogenic carcinoma, mesothelioma of the pleura and peritoneum, asbestosis, and cancer of the stomach, colon, and rectum.

Cancer of Lung, Pleura, and Trachea.—In published mortality data for the United States showing deaths each year from various causes by age, sex, and race, the following diseases are combined: cancer of the lung (including sarcoma of the lung), cancer of the bronchus, cancer of the pleura, and cancer of the trachea. For this group of diseases, there were 27 observed deaths and only 2.3 expected deaths, a ratio of nearly 12 to 1.

It is well known that, for the United States as a whole, all except a very few of the deaths reported in the combined category are due to bronchogenic carcinoma. Thus, it may be assumed that there were close to 2.3 expected deaths from this cause as compared with 24 observed deaths, a ratio of over 10 to 1.

Mesothelioma.—Ten of the 94 observed deaths were due to mesothelioma, three were due to pleural mesothelioma, and seven were due to peritoneal mesotheliomas. This is such a rare disease that if the 370 subjects had been selected as a random sample from the general population, one would not have expected any of them to die of mesothelioma within a period of 52 months.

All three of the men who died of pleural mesothelioma had a history of regular cigarette smoking. Of the seven who died of peritoneal mesothelioma, one never smoked regularly, one smoked only pipes and cigars, and five had a history of regular cigarette smoking.

Cancer of Stomach, Colon, and Rectum.—In our earlier study of asbestos workers,[1] there were more deaths than expected from cancer of the stomach, colon, and rectum (9.4 expected, 29 observed). As compared with a total of 1.8 expected deaths from these causes, there were eight observed deaths in this study, due to cancer of the following sites: stomach, three; colon, four; and rectum, one. Although this bears out our earlier findings, the number of deaths from these causes was so small that we still refrain from drawing any conclusion at this time.

Asbestosis.—Asbestosis accounted for 15 of the 94 deaths. While it is not surprising that deaths from this disease occur among men exposed to asbestos dust, attention must be called to the fact

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