

## LUNG CANCER IN COAL MINERS--RECENT RESULTS

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### ABSTRACT

An association of exposure to environmental pollutants with the development of lung cancer is well recognized. The possible association of an occupational exposure to the development of lung cancer is also a subject of major concern. Several substances, notably asbestos, uranium, nickel, chloromethyl ether and arsenic are recognized etiologic factors in the development of lung cancer. The effect of occupational exposure to coal mine dust on the prevalence of lung cancer has not been adequately determined. Epidemiologic studies have shown conflicting results on the prevalence of lung cancer in coal miners. Inadequate control of confounding factors such as smoking may be the cause of this disparity.

Cigarette smoking is recognized as the most influential etiologic risk factor in the development of lung cancer. Since the majority of coal miners smoke (72%) the separation of the independent effects of two major suspected risk factors, i.e., smoking and exposure to coal mine dust, is difficult. This is further complicated by the additive and/or synergistic effects of risk factors which are known to mask or modify the independent effect of risk factors.

Comparisons of histological cell types and their relative frequencies among occupationally exposed and general populations have provided valuable information in the evaluation of the effect of risk factors. The most important risk factor is smoking, which is known to influence the frequencies of cell types in a dose dependent manner, producing more squamous and oat cell carcinomas. Histological cell type frequencies of lung cancer in groups occupationally exposed to asbestos, chloromethyl ether and uranium workers have shown promising results on the separation of risk factors.

To determine a possible relationship between coal dust exposure and lung cancer prevalence, a group of lung cancer cases was matched with non-lung cancer cases on region, age and smoking pack years to evaluate the effect of coal mining on development of lung cancer.

The National Coal Workers Autopsy Study (NCWAS) provides free autopsies to all underground coal workers and was established in 1972 by an act of the United States Congress. From its inception through 1980, 3,341 autopsies were accepted from 24 coal mining states by the National Institute of Occupational Safety and Health (NIOSH). Among these, 331 cases (9.9%) were submitted with a diagnosis of lung cancer. Each case submitted to this study provides full demographic data,

occupational and smoking histories, together with autopsy reports and 3 or more blocks of lung tissue and slides.

Histological cell typing of lung tumors was initially evaluated according to WHO classification of lung tumors in 306 cases by a panel of 4 pathologists, without prior knowledge of autopsy findings or smoking and mining histories. Subsequently a subgroup of 171 primary lung cancer cases was selected from the total of 306 cases in which the diagnosis of a primary lung cancer was beyond any reasonable doubt.

The 3,341 NCWAS cases had an average age of  $62 \pm 11$  years, with an underground mining history of  $26 \pm 14$  years. Nearly 72% of the miners had a smoking history with an average of  $25 \pm 19$  pack years. The age and mining histories were similar in the 331 group of lung cancer cases and the subgroup of 171 cases with primary lung cancer.

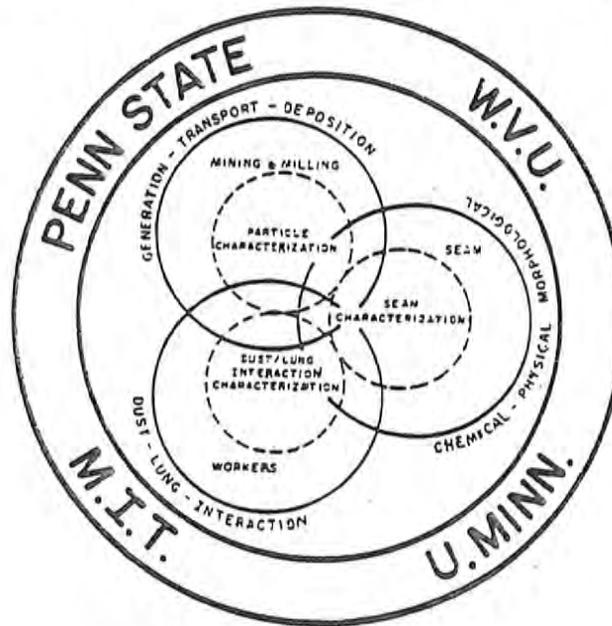
Distribution of lung cancers by histological cell type in 306 cases showed no major differences in 3 major cell types of squamous, small cell, and adenocarcinomas. On the other hand, in the 171 primary lung cancer cases the squamous cell cancer was the predominant type followed by equal proportions of adenocarcinomas and small cell carcinomas. Conversely adenocarcinoma was the most frequent cancer (84%) in the cases excluded as probably metastatic cancers. In 149 cases from the subgroup of 171 primary lung cancer cases the tumors originated mainly in the upper lobes (45%) and main stem bronchi (29%), whereas in 26% of the cases the exact location of origin was not well defined.

Distribution of lung cancer by site of origin and cell type showed that the majority of the squamous cancers originated in the main stem bronchus whereas adenocarcinomas tended to originate predominantly in the peripheral lung. The small cell cancers also originated mostly in the central areas of the lung.

The frequency distribution of cancer cases by cell type and smoking showed a higher proportion of squamous cell cancers in smokers with 40+ years of smoking history. Distributions of cell type by age showed a higher proportion of squamous cell cancers in older miners. No independent effect of mining tenure on histologic type was noted. The overall pathological features of lung cancer in coal workers are very similar to those reported for non-miner smoking males in the general population. The absence of any effect of mining tenure on cell type strongly indicates that coal dust per se does not influence the histogenesis of lung cancer in coal workers.

In order to determine if miners with lung cancer had greater coal mine dust exposure a separate analysis was performed. The 171 miners with confirmed lung cancer were matched by age and pack year smoking history on a one to one basis with miners who did not have lung cancer. The years of underground mining experience (as a surrogate of coal mine dust exposure) was almost identical in both groups indicating that mining exposure does not increase the risk of lung cancer. These epidemiologic and morphologic studies provide evidence that mining by itself does not influence either the histogenesis or prevalence of lung cancers in this population of coal miners.

# Generic Mineral Technology Center for Respirable Dust



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MORGANTOWN, WEST VIRGINIA  
OCTOBER 8-10, 1984

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## PROCEEDINGS

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