

Reprinted from: BIOLOGICAL EFFECTS OF MINERAL FIBRES, Vol. 2
J. C. WAGNER
Lyon, (IARC Scientific Publications No 30) 1980

THE INFLUENCE OF OCCUPATIONAL AND ENVIRONMENTAL
ASBESTOS EXPOSURE ON THE INCIDENCE OF MALIGNANT
MESOTHELIOMA IN CONNECTICUT

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INTRODUCTION

The combined sex age-adjusted mesothelioma incidence rate for Connecticut was reported recently to have increased ten-fold since 1935. Although available statistics might be subject to diagnostic error, the apparent rise was attributed to the increase in the state's 'cumulative asbestos consumption'. Complete occupational histories for the 133 cases of mesothelioma were not presented. An ambient air standard of 30 ng/m³ measured over a 30-day interval was proposed and was justified by the reported rise in the state's mesothelioma incidence (Bruckman, 1978).

In the present study, the cases of mesothelioma recorded in the Connecticut Tumor Registry (CTR) were re-examined to determine the role of occupational and environmental exposures and to consider possible diagnostic errors through review of available histological material.

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MATERIAL AND METHODS

The 229 cases of malignant mesothelioma identified by the CTR occurred at the following sites: pleura (147), peritoneum (33) and other sites (49); pleural tumours other than mesotheliomas were also recorded (38) (Table 1). Medical, demographic and occupational data were collected for the cases and for their respective spouses from hospital records, death certificates and City Directories (The Price and Lee Company, 1890-1977). Similar information was gathered for a random sample of decedents in Connecticut aged 20 to 98 years. The 1970 US Census Industrial and Occupational Codes (US Department of Commerce, Bureau of the Census, 1971) were assigned to the employment information obtained. Those cases with occupations associated in the literature with malignant mesothelioma were selected for study from all those with occupations in which there was probable asbestos exposure (Hutchison, 1976; Levine, 1978; McDonald, 1979; Weston, 1976).

Table 1. Sex, age and diagnostic characteristics of cases of malignant mesothelioma and other pleural tumours diagnosed in Connecticut, 1935-1977

Diagnosis ^a	Males	Females	Total	Mean age	Percent 'positive' ^b histology	Percent autopsied ^c
Pleural mesothelioma	102 (94) ^d	45 (37)	147 (131)	61 (62)	93 (95)	40 (38)
Pleural tumour (other than mesothelioma)	24 (12)	14 (8)	38 (20)	62 (63)	71 (85)	35 (37)
Peritoneal mesothelioma	20 (18)	13 (11)	33 (29)	58 (59)	94 (97)	89 (88)
Mesothelioma at other sites & at unknown sites	29 (21)	20 (14)	49 (35)	52 (54)	84 (86)	33 (41)
Total	175 (145)	92 (70)	267 (215)	59 (60)	88 (93)	44 (45)

^a World Health Organization (1976)

^b SEER, 1976 Code/Field Number 19 (US Department of Health, Education, and Welfare, National Cancer Institute, 1976)

^c (No. autopsied/no. deceased) × 100

^d Numbers in brackets refer to the period 1955-1977

Descriptive epidemiology for this research pertains to the time interval 1935-1977. Case-control comparison and statistical modelling include 215 cases diagnosed after 1954 and 605 controls (1955-1977). Information from 1935-1954 was inadequate for such comparisons due to limited occupational and clinical data and to the lack of awareness of mesothelioma.

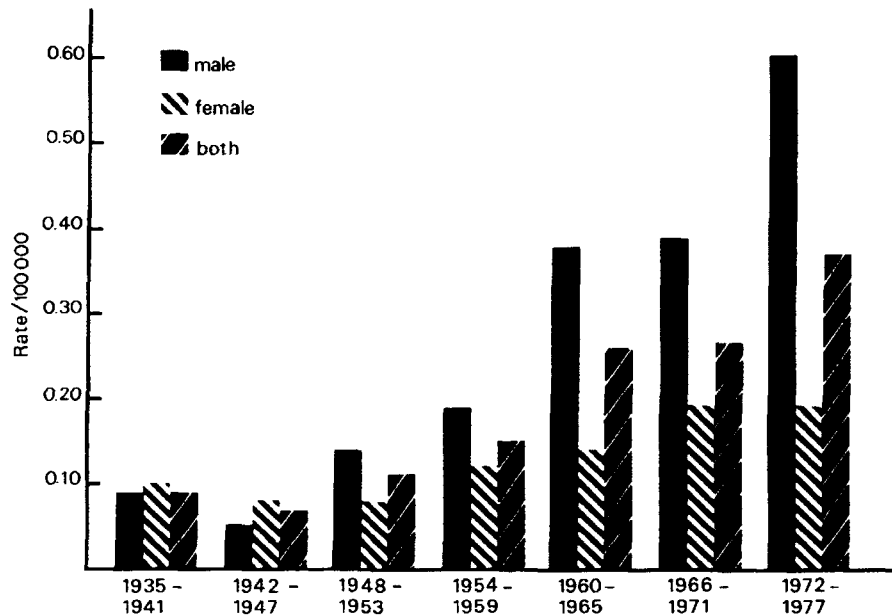
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RESULTS

The crude incidence rate for mesothelioma in Connecticut is 2.2/million for the years 1935-1977. Age-adjusted incidence rates per 100,000 population (using the 1950 US population as a standard) increased for both sexes, but there was a rapid rise from about 1960 for males (Fig. 1). Of the 229 cases, 195 were reported after 1954. The mean age at diagnosis was 59 years. The geographic distribution of these cases reveals a clustering in dense urban areas. Ten cases were reported (1955-1977) in an area where shipyards are located, and five of these were identified between 1975 and 1977.

FIG. 1. AGE-ADJUSTED INCIDENCE RATES OF MESOTHELIOMA IN CONNECTICUT BY YEAR OF DIAGNOSIS AND SEX



A logistic regression model was fitted to examine the incidence of pleural mesothelioma (1955-1977) as a function of time, age and sex. Connecticut population figures were used for denominator data in the

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estimate of disease probability. The main effects model provided a reasonably good fit ($P > 0.10$). Relative risks (here approximated by the odds ratio) over time intervals, age categories and sex groups were estimated. Persons alive in 1975-1977 had a 3.5 times greater risk of developing pleural mesothelioma than those alive between 1955 and 1964 (95% confidence intervals (CI): 2.25, 5.48). With progression across the age intervals 45-54, 55-64, 65-74..., the individual risk of this disease is 1.5 times greater than in the preceding ten-year age group (95% CI: 1.13, 1.31). Males have 3.0 times the risk of females (95% CI: 2.10, 4.22).

These descriptive and analytical results assume completeness and accuracy of case identification. A sizeable proportion (56%) of the 267 cases were not autopsied; and autopsy percentages for pleural tumours other than mesothelioma and for mesotheliomas at other or unknown sites are low - 35% and 33%, respectively. The unknown site group had a mean age of only 52 years (Table 1). The differentiation of cases of malignant pleural tumours into mesothelioma and other pleural tumours is suspect. A discriminant function analysis of these two groups of cases (diagnosed after 1954) on the basis of age, sex, survival time, stage and number of tumours yields a 60% misclassification. These results suggest possible misdiagnosis and the advisability of a case review, which is made feasible by the large proportion of patients diagnosed on the basis of available histological material (Table 1).

When the mesothelioma incidence has been adjusted for diagnostic weaknesses and misclassifications and when the occupationally exposed cases, controls and spouses have been identified, it may be possible to determine the role of environmental asbestos exposure, if any, in the remaining cases.

SUMMARY

Medical, occupational and demographic data were collected for 229 cases of malignant mesothelioma and 38 other pleural tumours, their spouses, and 605 controls. Methods were developed for classifying subjects into probable asbestos exposure categories. Although disease incidence rates exhibited a rapid increase from 1955 to 1977, there remains a serious question of diagnostic reliability. A case review is being undertaken.

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RESUME

Les auteurs ont recueilli des données médicales, professionnelles et démographiques sur 229 sujets atteints de mésothéliome malin et 38 d'autres tumeurs pleurales, leurs conjoints et 605 témoins. Ils ont mis au point des méthodes permettant de classer les individus en catégories d'exposition probable à l'amiante. Bien que les taux d'incidence de la maladie accusent une rapide augmentation de 1955 à 1977, il subsiste un sérieux problème de fiabilité diagnostique. Une étude de cas individuels est présentement entreprise.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the technical assistance of
Linda Ziter Mowad, R.N. of the Connecticut Cancer
Epidemiology Unit and of Kathleen Pinto of
Raybestos-Manhattan, Inc.

This investigation was supported by grants number
N01 CP 33235 and N01 CP 61002 awarded by the
National Cancer Institute, DHEW, and by the
Institute of Occupational Medicine and
Hygiene, Yale University School of
Medicine.

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