

MALIGNANT MESOTHELIOMA AND ASBESTOS EXPOSURE IN NSW

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INTRODUCTION

Malignant mesothelioma is a cancer of the mesothelial cells which line body cavities and envelop organs such as the lung (pleura), heart (pericardium) and intestines (peritoneum). Exposure to asbestos or asbestiform fibres is the only known cause of the disease and accounts for 80-85 per cent of all cases¹. It is one of the very few human cancers which is a hallmark of exposure to a single environmental agent.

Workplace exposure to asbestos, particularly to the mineral amphiboles (crocidolite and amosite) is the main risk factor for this disease². In Australia this exposure is most likely to have occurred in the period 1944-1966 in the asbestos mining, manufacturing or processing industries, in shipbuilding or in the construction industries³. Concerns linger about the potentially hazardous effects of environmental or asbestos exposure. Some authors have predicted a "third wave of asbestos-related disease"⁴ because of this environmental exposure.

In this article we examine the patterns of production and use of asbestos in NSW and trends in the incidence and distribution of malignant mesothelioma in NSW.

ASBESTOS PRODUCTION, CONSUMPTION AND EXPOSURE IN NSW

Asbestos fibre types can be ranked in terms of their propensity to induce mesothelioma: erionite (a zeolite mineral linked with very high rates of mesothelioma in rural Turkey), crocidolite (blue asbestos), tremolite, amosite (brown asbestos) and chrysotile (white asbestos)⁵. Chrysotile asbestos was by far the type used most commonly in Australian industry⁶.

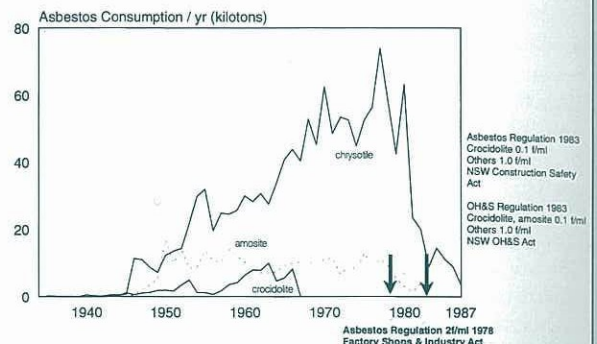
Among Australian States, NSW has been the leading consumer of all commercial types of crude asbestos fibre. Two asbestos mines, at Baryulgil and Barraba, produced significant amounts of chrysotile asbestos for the local market and for export. Added to this were imports of chrysotile, crocidolite and amosite for use in a wide range of industries. Data from the National Mesothelioma Surveillance Program reveal that of those people exposed to asbestos, 66 per cent had their first asbestos exposure in NSW⁷.

Australian import, export and production figures for the years 1935-1980, by fibre type, were obtained from reports published by the Commonwealth Bureau of Mineral Resources, Geology and Geophysics^{7,8}. The consumption of asbestos was calculated from these figures (Figure 3). Imports of processed asbestos products were excluded from this calculation. Also included in this figure are the important legislative changes which had an impact on workplace asbestos exposure over this period. The use of crocidolite asbestos declined rapidly after 1966, and imports were banned in 1968, but chrysotile and to a lesser extent amosite had peak exposures in the 1970s and declined only in the early 1980s.

There has been a sharp decline in usage in the building and construction industry but asbestos continues to be used in

FIGURE 3

ASBESTOS CONSUMPTION IN AUSTRALIA, BY FIBRE TYPE, 1947-87, AND DATES OF MAJOR LEGISLATED REFORMS IN ASBESTOS CONTROL IN NSW



Source: Commonwealth Bureau of Mineral Resources, Geology & Geophysics.

the automotive industry (for brake linings) and for industrial gaskets and seals.

MALIGNANT MESOTHELIOMA IN NSW

We obtained data on mesothelioma occurrence in NSW from the Australian Mesothelioma Surveillance Program (the program) and the Australian Mesothelioma Register (the register). The rationale and methods used in these data collections are described in detail elsewhere⁹. Briefly, from 1980 to 1985 there was an intensive case finding and detailed data collection on notified mesothelioma cases. When the program ended, the register was established to continue monitoring of the incidence of mesothelioma and to collect less detailed information on each case. For this analysis, data on year of birth, sex, age at diagnosis, year of diagnosis and postcode were available. Data after 1991 are likely to be incomplete because of the lag time involved in notification.

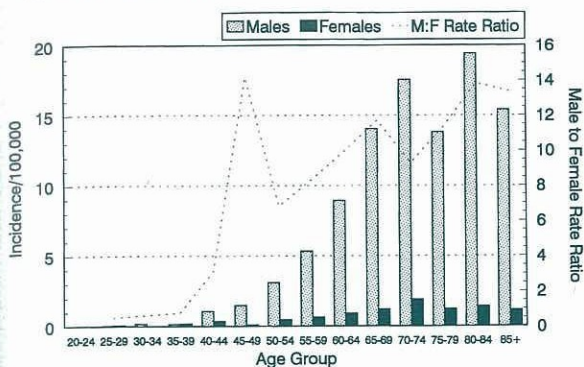
Data on mesothelioma incidence between 1947 and 1980 have been drawn from data published by Musk et al⁹. These data were obtained from members of the Royal College of Pathologists of Australasia. The NSW data from this paper have been appended to data from the program and the register to illustrate long-term trends in mesothelioma incidence. Standardised Incidence Rates (SIR) were calculated using the world population as a reference population. The age-adjusted trend for males and females between 1980 and 1990 was estimated using Poisson regression⁹. The criterion of significance for an increasing trend was that the confidence limits of the mesothelioma trend did not overlap the confidence limits for the trend in cancers at all sites¹⁰.

All statistical analyses were conducted using SAS statistical package Version 6.08. Directly age-standardised rates were calculated using the method of Dobson et al¹¹. SIR and their

a Poisson models were fit using proc genmod in SAS Windows Version. The model used was: $\log(\text{incidence rate}) = \alpha_0 + \beta_1(\text{age}) + \beta_2(\text{year})$. Age entered as a grouped variable produced a better model fit. The average annual change in incidence rate was calculated from the maximum likelihood estimate of the parameter for year.

FIGURE 4

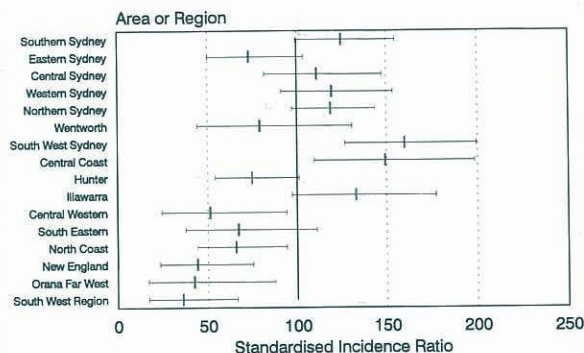
MESOTHELIOMA INCIDENCE IN NSW 1980-1992 BY AGE GROUP AND SEX



Source: Australian Mesothelioma Program and Register

FIGURE 5

MESOTHELIOMA IN MALES NSW 1980-1989 STANDARDISED INCIDENCE RATES BY AREA OR REGION



Source: Australian Mesothelioma Program and Register
Reference Population = NSW

95% confidence intervals¹² were calculated for each Area and Region, using the NSW population as a reference.

RESULTS

Between 1980 and 1992 there were 992 cases of mesothelioma in NSW. Males accounted for 88.3 per cent of cases. The mean age for males was 65.9 years and for females was 64.4 years (Figure 4). The male:female ratio rises rapidly with increasing age.

SIR for mesothelioma among males by Area and Region are shown in Figure 5. Both the Central Coast and South West Sydney Areas had higher than expected cases of mesothelioma. The SIR for the Central Coast was 1.56 (95% CI 1.15-2.05) and for South West Sydney was 1.60 (95% CI 1.27-2.00).

Over the past 15 years there has been a significant increase of 4.2 per cent a year (95% CI 2.7-5.9%) in the incidence of malignant mesothelioma in men. In women the rate of increase is 3.8 per cent (95% CI -0.005-8.3%), but this result is not statistically significant (Figure 6). Age-specific trends show the steepest increase is in men above 60 years of age (Figure 7).

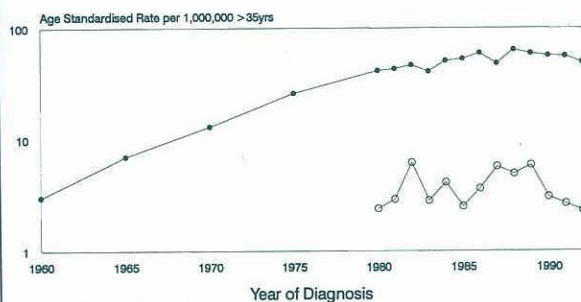
DISCUSSION

The rising incidence of malignant mesothelioma in NSW is the regional manifestation of what has been called "the most disastrous occupational epidemic in Australia's history". This disease claims more lives each year than any other work-related cause of death¹³. This review of trends in incidence data in NSW provides little evidence that the end of the epidemic is in sight. The 4 per cent annual increase in incidence is comparable to increases observed nationally¹⁴. The steep increase in incidence between 1975 and 1980 is due to the systematic under-estimation of mesothelioma incidence before the National Mesothelioma Surveillance Program. While the uncertainties of ascertainment of previous individual histories of occupational exposure and lung clearance rates of the fibres limit the ability to predict the final trajectory of this epidemic it is not likely that the incidence rate will begin to fall until 2010¹³.

Continued on page 54 ▶

FIGURE 6

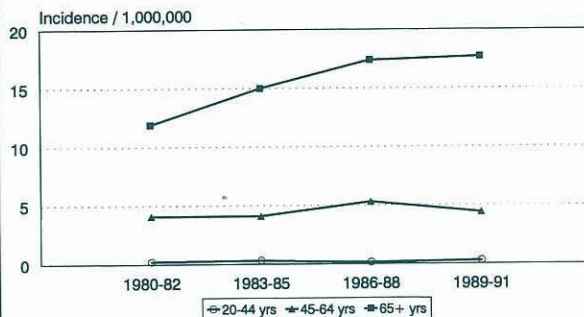
MALIGNANT MESOTHELIOMA NSW 1960-1992 AGE-STANDARDISED INCIDENCE RATES



Source: Worksafe Mesothelioma Register
ABS Census Data, Musk et al
◆ Males ○ Females

FIGURE 7

AGE-SPECIFIC TRENDS IN THE INCIDENCE OF MALIGNANT MESOTHELIOMA IN NSW 1980-1991



Source: Worksafe Mesothelioma Register
ABS Census Data, Mask et al.

Malignant mesothelioma and asbestos

► Continued from page 53

In NSW, as elsewhere, the major impact of this epidemic has been on men who worked in high-risk industries such as asbestos mining or manufacture, shipbuilding or construction. The risk was highest in the period before legislated health and safety prohibitions on exposure and during the period of high asbestos consumption between 1940 and 1975.

The incidence rate for malignant mesothelioma in NSW is one of the highest in Australia. Only Western Australia and South Australia have higher rates and in Western Australia many cases can be attributed to exposure to crocidolite in the course of employment or residence at Wittenoom¹⁵. These findings accord with the previously mentioned observation that NSW was the State in which more than two-thirds of all mesothelioma cases reported nationally were first exposed to asbestos, and with the concentration of asbestos manufacturing and heavy industries in this State.

The distribution of reported cases in NSW shows, as expected, higher rates in urban than in rural areas and higher rates in industrial areas, with the Hunter region being an exception. High rates in the Gosford-Wyong region probably reflect the high number of elderly people in that area. However, the average time between first exposure to asbestos and the diagnosis of mesothelioma is 37 years³ and this long latency period increases the chance of committing the ecological fallacy – wrongly attributing cause or place of first exposure to a locality.

In NSW, occupational exposure to asbestos is limited to the small numbers of workers in the now tightly regulated asbestos removal and brake lining and gasket manufacturing industries. The contemporary public health issue is whether the very low levels of asbestos found in both the urban environment and in the lungs of most urban dwellers¹⁶ will be a cause of future cases of malignant mesothelioma. In the US and in Britain the absence of any rising trend in mesothelioma incidence in women is cited as evidence that ambient exposure to asbestos does not increase occurrence of mesothelioma. This inference cannot be made in NSW, where the incidence of mesothelioma in women is rising. This increase may be attributable to well-recognised occupational or para-occupational exposures or to non-occupational exposures. The fact that a significant proportion of women with mesothelioma (46 per cent) report previous exposure in both the program (1978-85) and the register (1986-92)¹⁷ supports the former hypothesis, although the surveillance of mesothelioma trends in women, and their exposure histories, should continue.

There have been no general surveys of non-occupational exposure to asbestos in NSW, but overseas data indicate

that exposures in the urban population not directly exposed to asbestos are likely to be in the < 0.0001-0.0005 fibres/ml range¹. If an individual is exposed for a lifetime to asbestos levels of this magnitude, it has been estimated that he or she has less than a 1 in 100,000 chance of developing malignant mesothelioma¹⁸. These estimates suggest it is unlikely that exposure at these levels will contribute substantially to the occurrence of mesothelioma in coming years. The tragic inevitability of future cases of mesothelioma in NSW can therefore be largely attributed to exposures which occurred between 1940 and 1980.

ACKNOWLEDGMENTS

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