Changing Trends in Mesothelioma Incidence

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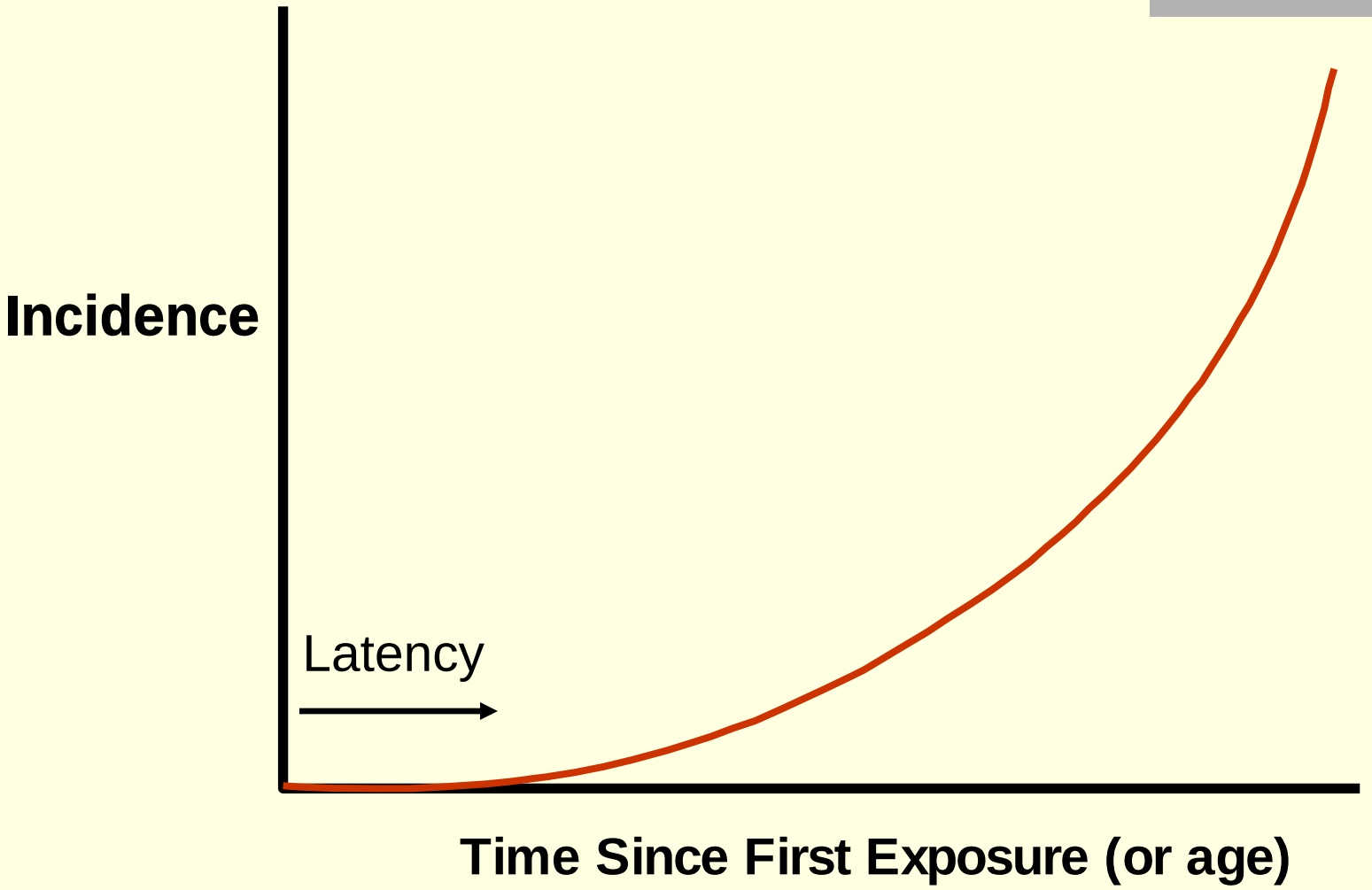
Professor of Medicine Emeritus
Tulane University Medical Center

International Conference on Chrysotile
Montreal, May 23, 2006

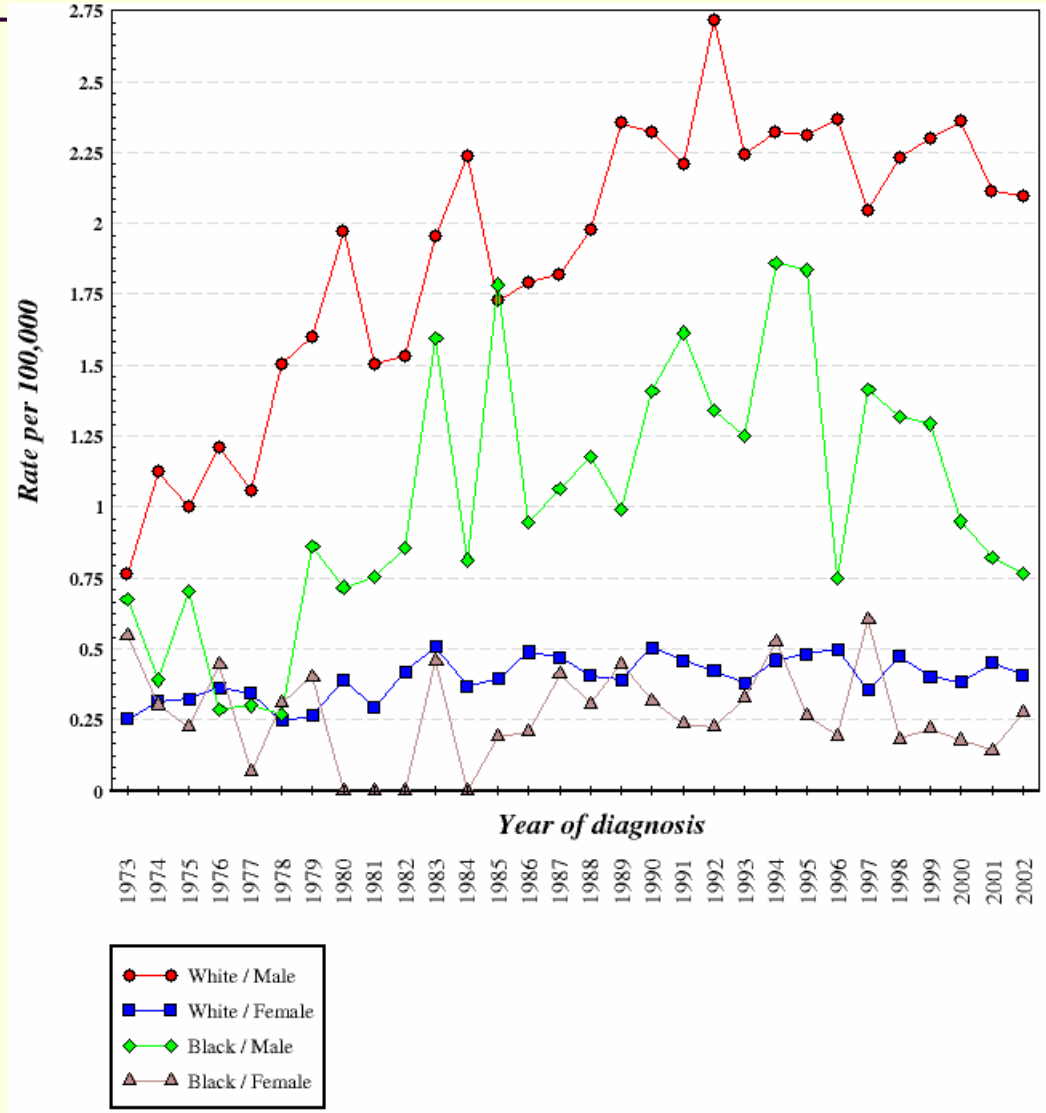
Global Mesothelioma Trends

- United States
  - SEER (National Cancer Institute)
  - Weill, Hughes & Churg
  - Price & Ware
- United Kingdom
- Europe
- Australia

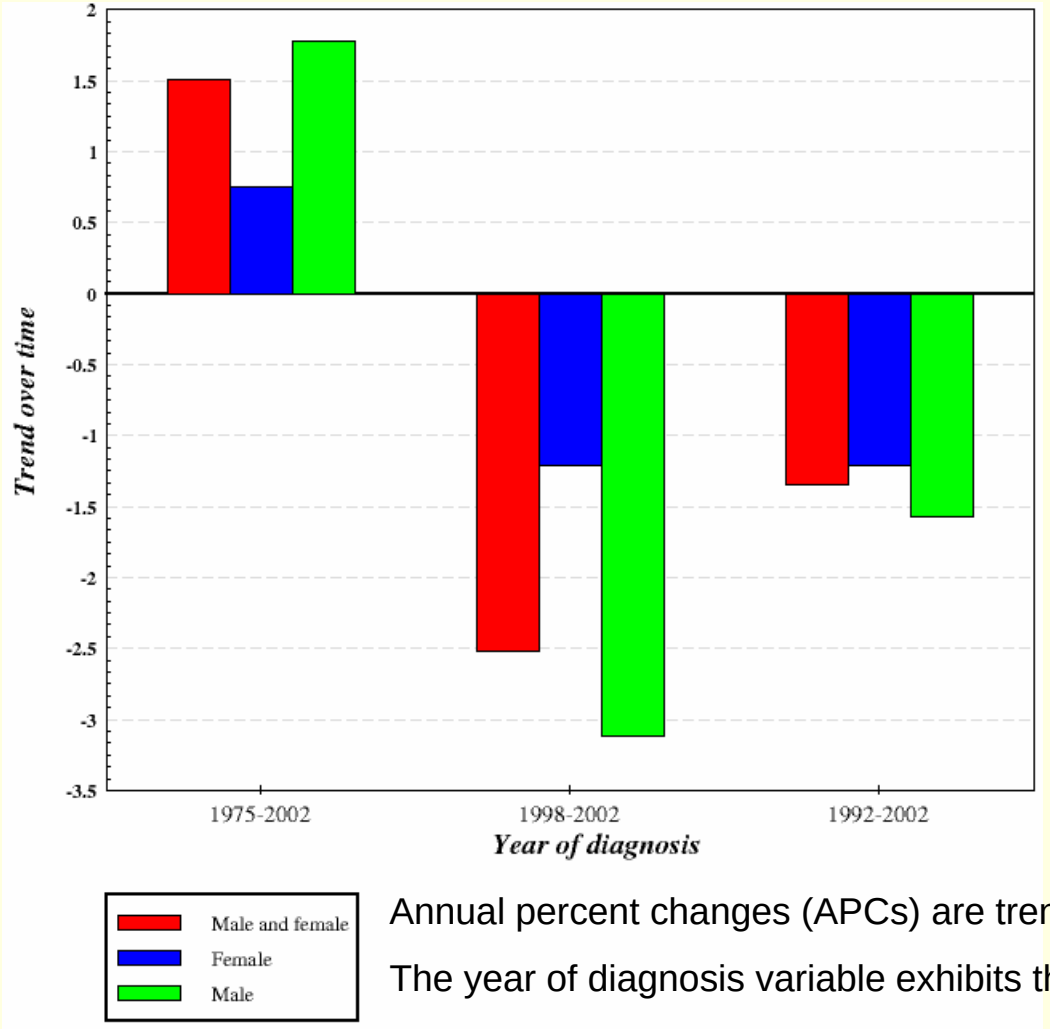
Mesothelioma Incidence Since Time from First Exposure



SEER Age Adjusted Incidence Rates by Race and Sex For Mesothelioma, All Ages SEER 9 Registries for 1973-2002



Trends (APC) of SEER Incidence Rates by Sex For Mesothelioma, All Ages, All Races SEER 9 Registries for 1975-2002, 1992-2002, 1998-2002



Annual percent changes (APCs) are trends over time.

The year of diagnosis variable exhibits the time period

ORIGINAL ARTICLE

Changing trends in US mesothelioma incidence

H Weill, J M Hughes, A M Churg

Occup Environ Med 2004;**000**:1–4. doi: 10.1136/oem.2003.010165

See end of article for authors' affiliations

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Accepted 2 November 2003

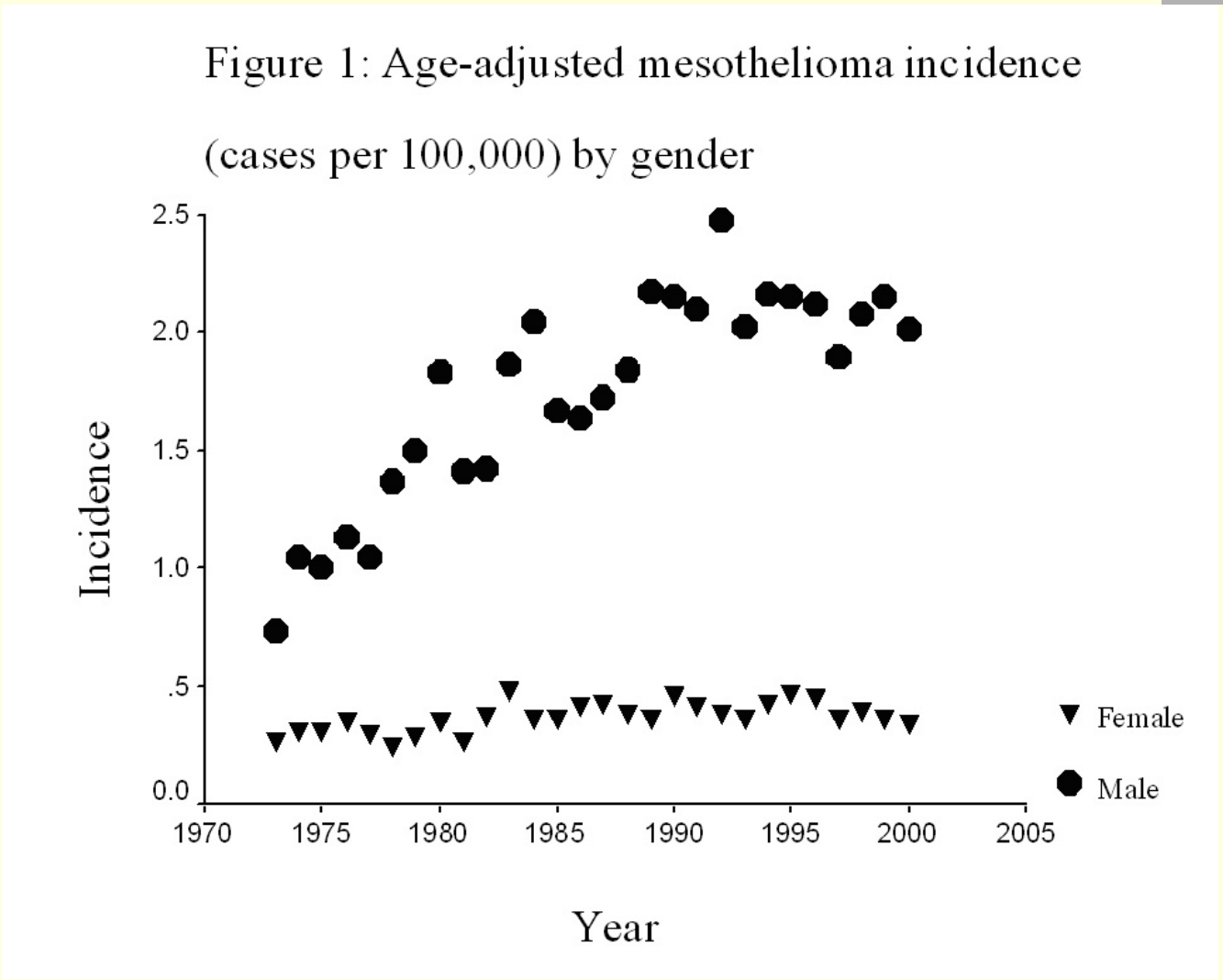
Aims: To report the temporal pattern and change in trend of mesothelioma incidence in the United States since 1973.

Methods: The Surveillance, Epidemiology, and End Results (SEER) programme of the National Cancer Institute has since 1973 provided annual age adjusted incidence for mesothelioma in representative cancer registries dispersed throughout the USA. SEER data are analysed to describe the trend of male mesothelioma incidence in the USA.

Results: The US male mesothelioma incidence data indicate that after two decades of increasing incidence, a likely decline has been observed since the early 1990s, when a highly significant change in the upward course occurred.

Conclusions: Increasing male mesothelioma incidence for many years was undoubtedly the result of exposure to asbestos. The high mesothelioma risk was prominently influenced by exposure to amphibole asbestos (crocidolite and amosite), which reached its peak usage in the 1960s and thereafter declined. A differing pattern in some other countries (continuing rise in incidence) may be related to their greater and later amphibole use, particularly crocidolite. The known latency period for the development of this tumour provides biological plausibility for the recent decline in mesothelioma incidence in the US. This favourable finding is contrary to a widespread fear that asbestos related health effects will show an inevitable increase in coming years, or even decades.

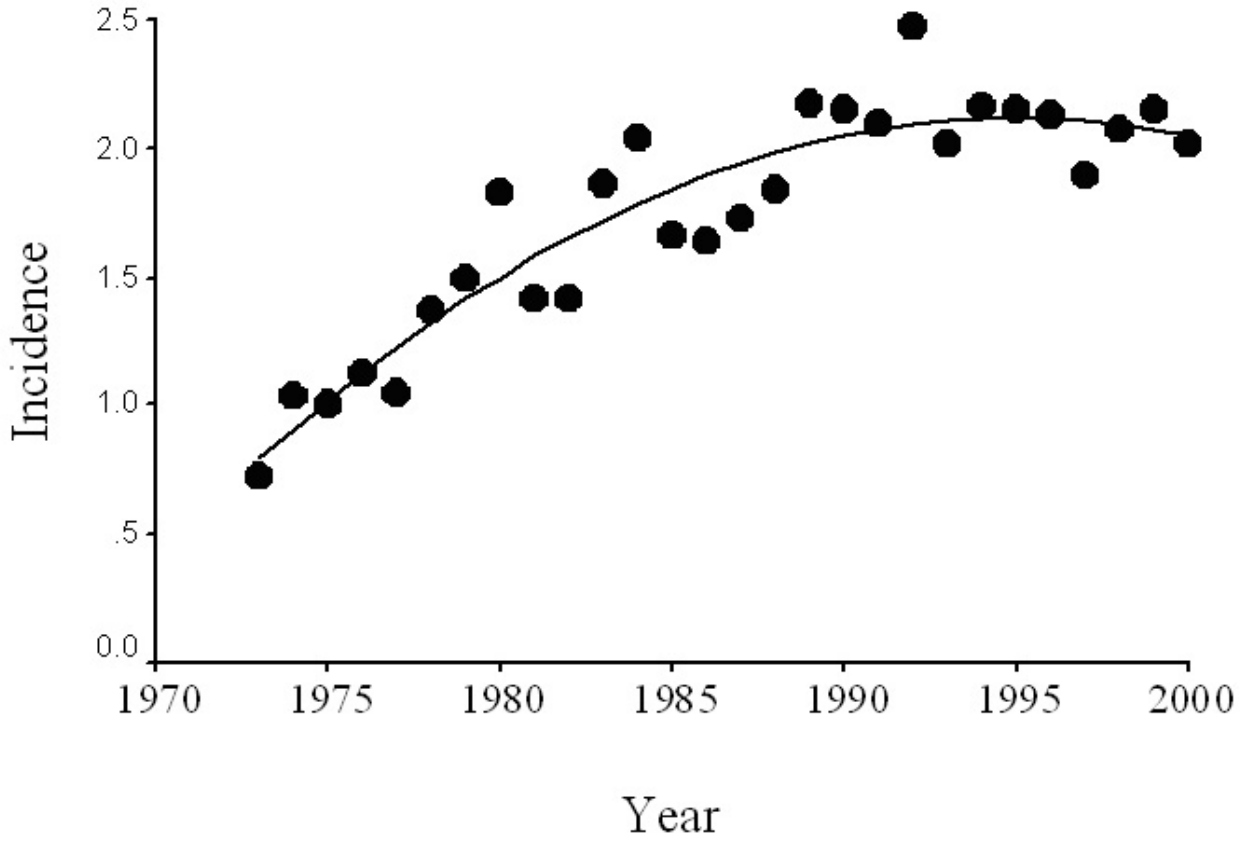
US Mesothelioma Incidence Trends - I



Weill, et al
OEM, 2004

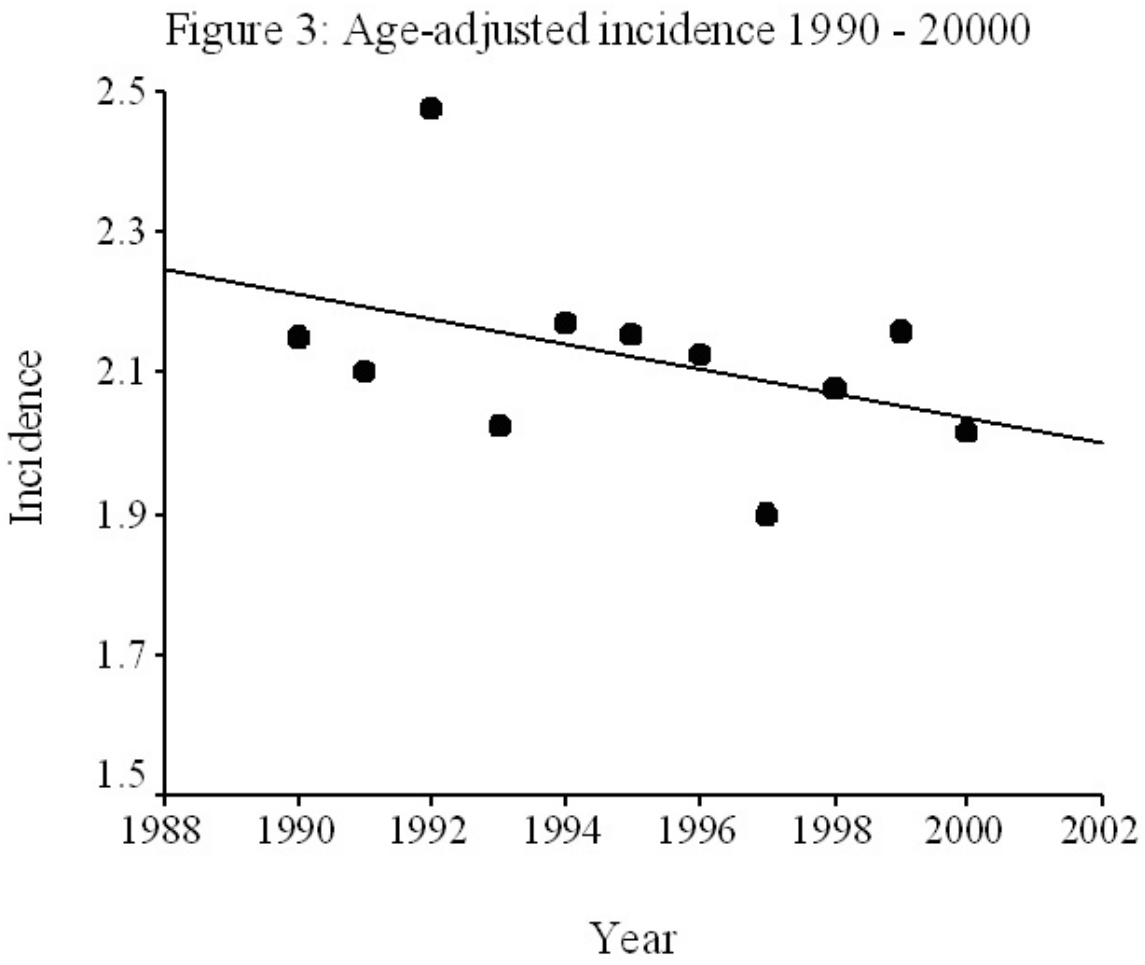
US Mesothelioma Incidence Trends - II

Figure 2: Male incidence and fit of quadratic model



Weill, et al
OEM, 2004

US Mesothelioma Incidence Trends - III



Weill, et al OEM, 2004

Conclusions

(Weill, Hughes & Churg Occup Environ Med 2004)

- Increasing male mesothelioma incidence for many years was undoubtedly the result of workplace exposure to asbestos.
- The high mesothelioma risk was prominently influenced by exposure to amphibole asbestos (crocidolite and amosite), which reached its peak usage in the 1960s and thereafter declined.
- A differing pattern in some countries (continuing rise in incidence) may be related to their greater and later amphibole use, particularly crocidolite.
- The known latency period for the development of this tumor provides biological plausibility for the recent decline in mesothelioma incidence in the US.
- This favorable finding is contrary to a widespread fear that asbestos related health effects will show an inevitable increase in coming years, or even decades.

Mesothelioma Trends in the United States: An Update Based on Surveillance, Epidemiology, and End Results Program Data for 1973 through 2003

Bertram Price and Adam Ware

American Journal of EPIDEMIOLOGY
Volume 159 Number 2 January 15, 2004

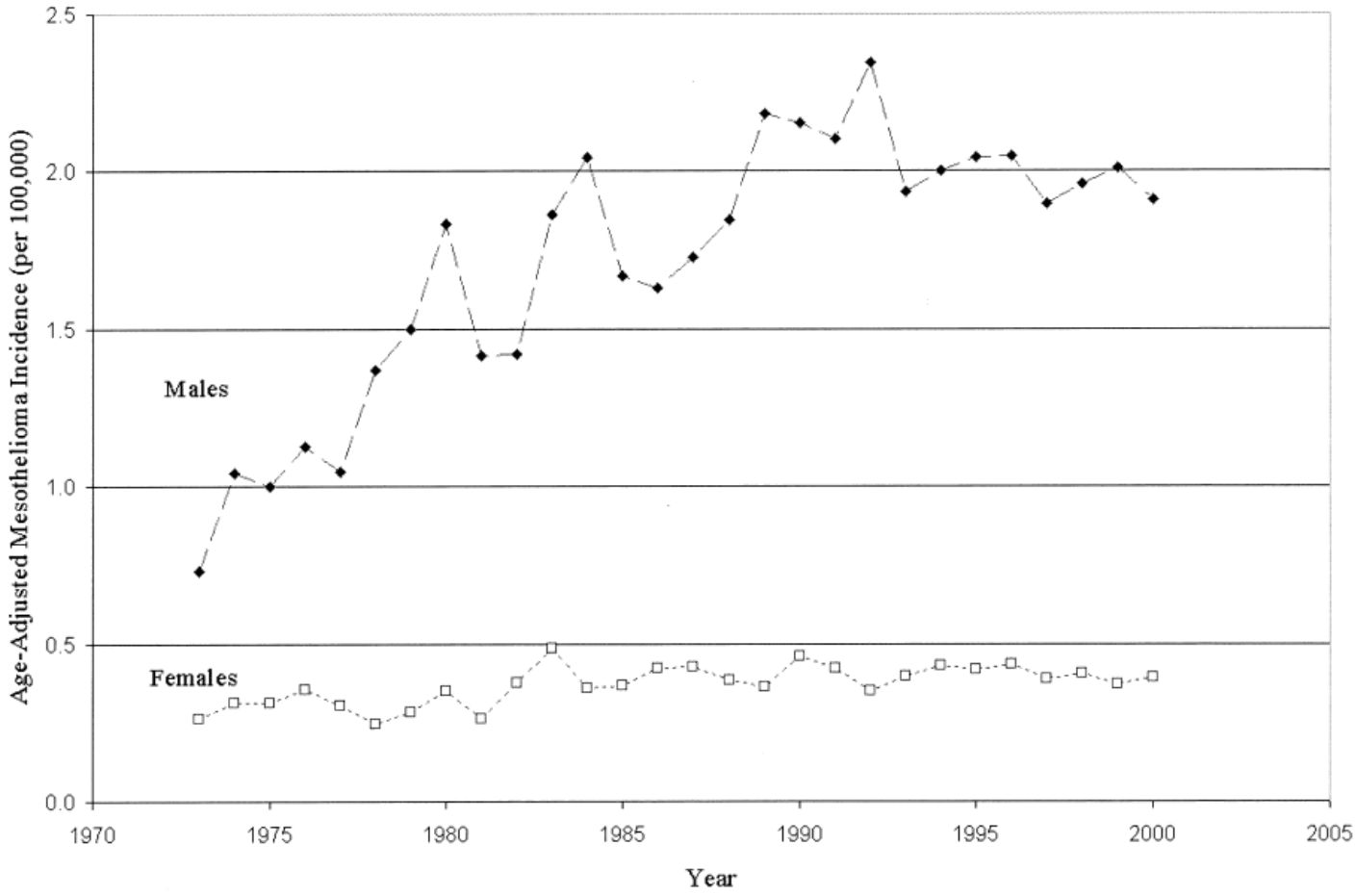


FIGURE 1. Age-adjusted incidence rates of mesothelioma (pleural + peritoneal) in the United States based on Surveillance, Epidemiology, and End Results Program data released in April 2003.

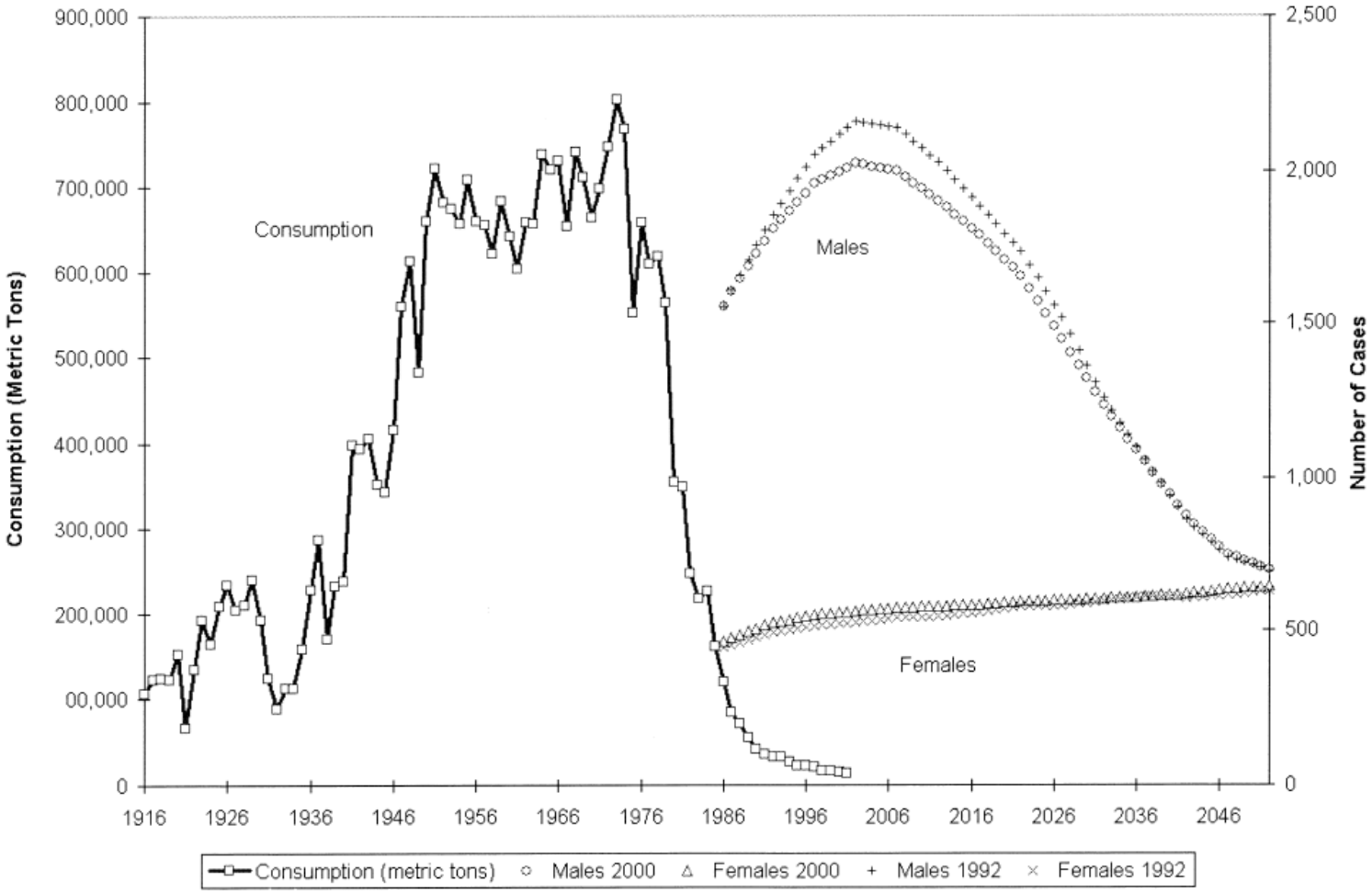


FIGURE 2. Asbestos use (consumption) in the United States and projected numbers of male and female mesothelioma cases based on a birth-cohort and age model estimated from Surveillance, Epidemiology, and End Results (SEER) Program data for two periods, 1973–1992 and 1973–2000.

British Journal of Cancer (2005) 92, 587–593

www.bjcancer.com

The expected burden of mesothelioma mortality in Great Britain from 2002 to 2050

JT Hodgson*[,1], DM McElvenny[1], AJ Darnton[1], MJ Price[1] and J Peto[2,3]

[1]Epidemiology and Medical Statistics Unit, Health and Safety Executive, Magdalen House, Trinity Road, Bootle, Merseyside L20 3QZ, UK; [2]Department of Epidemiology and Population Health, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK; [3]Epidemiology Section, Institute of Cancer Research, 15 Cotswold Road, Belmont, Sutton, Surrey SM2 5NG, UK

Future burden of mesothelioma mortality in Great Britain

(JT Hodgson et al 2005)

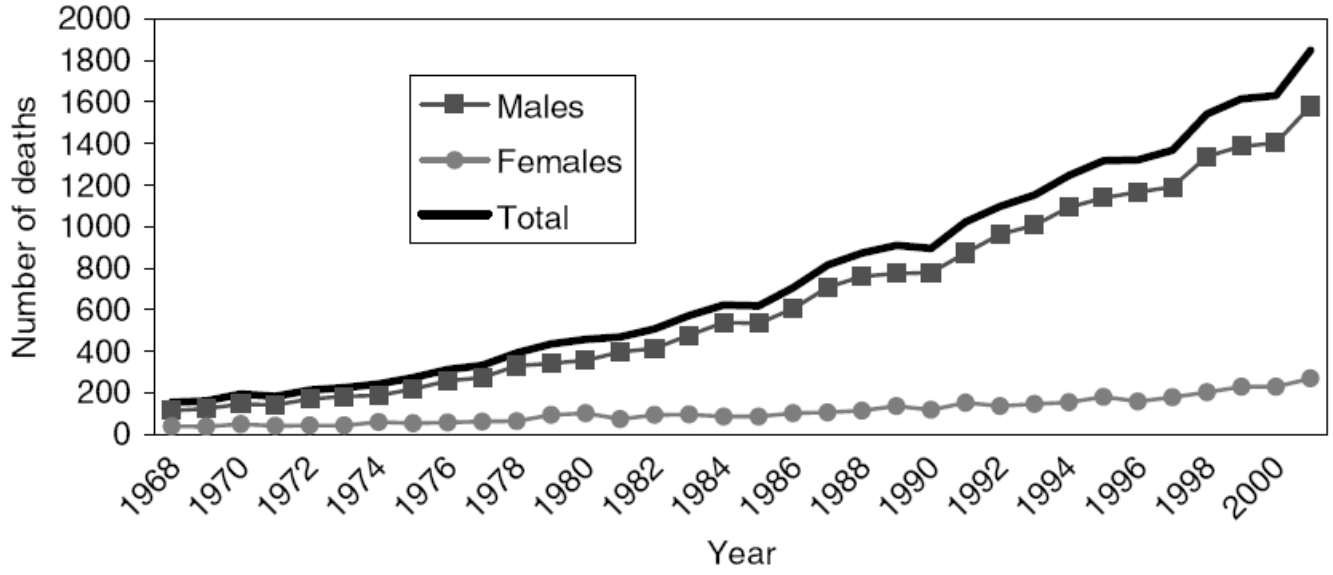
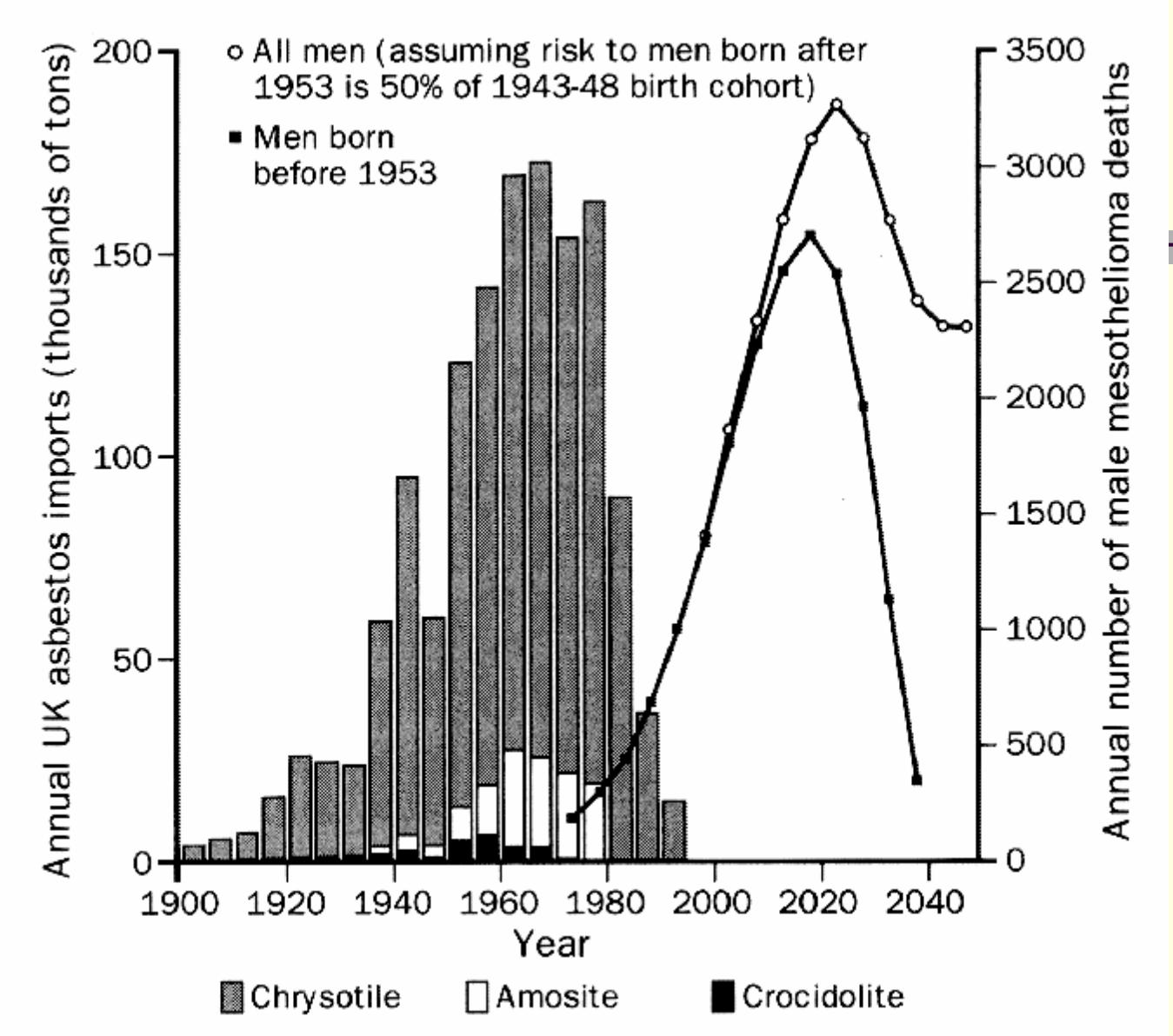


Figure 2 Mesothelioma deaths by sex and year.

Future burden of mesothelioma mortality in Great Britain

(JT Hodgson et al 2005)

The British mesothelioma register contains all deaths from 1968 to 2001 where mesothelioma was mentioned on the death certificate. These data were used to predict the future burden of mesothelioma mortality in Great Britain. Poisson regression analysis was used to model male mesothelioma deaths from 1968 to 2001 as a function of the rise and fall of asbestos exposure during the 20th century, and hence to predict numbers of male deaths in the years 2002–2050. The annual number of mesothelioma deaths in Great Britain has risen increasingly rapidly from 153 deaths in 1968 to 1848 in 2001 and, using our preferred model, is predicted to **peak** at around 1950 to 2450 deaths per year **between 2011 and 2015**. **Following this peak, the number of deaths is expected to decline rapidly**.



Predicted mesothelioma deaths in British men and UK asbestos imports
Peto: Lancet, Volume 345(8949).March 4, 1995.535-539

THE LANCET

Volume 345(8959) 13 May 1995 p 1234

Mesothelioma

[Letter To The Editor]

Weill, Hans; Hughes, Janet M

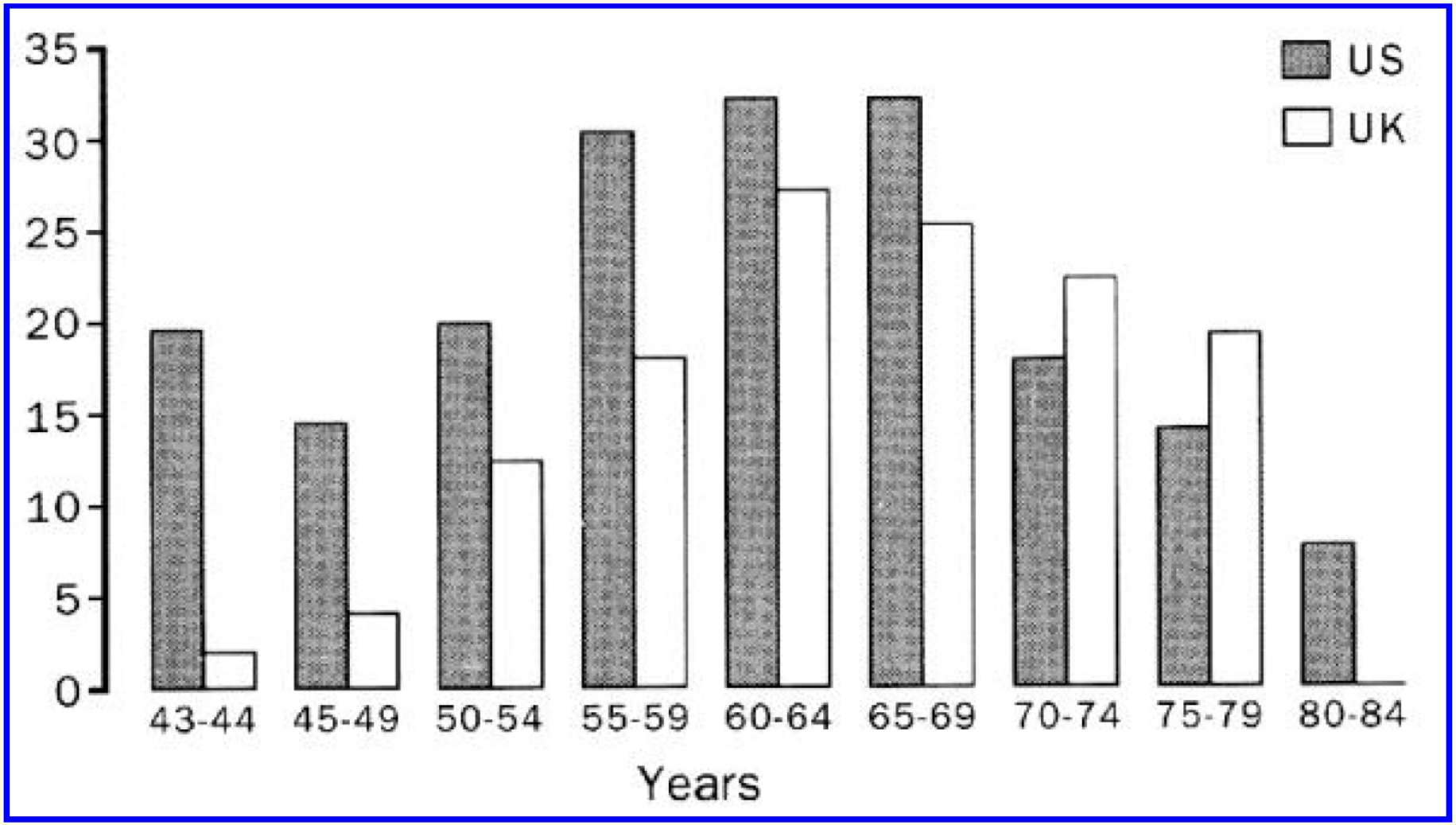


Figure 1. Yearly amphibole use in USA and UK Data in thousands of tons. USA data from Bureau of Mines, UK data from Peto et al.

We believe that the differential exposure to amphibole asbestos in the 1970s could be the most likely explanation for the UK/USA patterns of future mesothelioma rates reported by Peto et al; the explanation is clearly not different timing of peak total or amphibole asbestos use.

Mesothelioma mortality in Great Britain from 1968 to 2001

Damien M. McElvenny, Andrew J. Darnton, Malcolm J. Price and John T. Hodgson

Occupational Medicine **2005** 55(2):79-87

Health & Safety Executive—Epidemiology and Medical Statistics Unit, Stanley Precinct, Bootle, Merseyside L20 3QZ, UK

Background The British mesothelioma register contains all deaths from 1968 to 2001 where mesothelioma was mentioned on the death certificate.

Results The annual number of mesothelioma deaths has increased from 153 in 1968 to 1848 in 2001. Current deaths in males account for about 85% of the cases. The areas of West Dunbartonshire (SMR 637), Barrow-in-Furness (593), Plymouth (396) and Portsmouth (388) have the highest SMRs over the period 1981–2000. The occupations with the highest PMRs are metal plate workers (PMR 503), vehicle body builders (526), plumbers and gas fitters (413) and carpenters (388).

Conclusions These data reinforce earlier findings that geographical areas and occupations associated with high exposure to asbestos in the past continue to drive the mesothelioma epidemic in Great Britain. **However, the trends over time suggest a change in the balance of risk away from traditional asbestos exposure industries to industries where one could describe the exposure as secondary, such as plumbers and gas fitters, carpenters, and electricians.**

Occupational Medicine 2003;**53:**209–212
DOI: 10.1093/occmed/kqg051

The rise and fall in incidence of malignant mesothelioma from a British Naval Dockyard, 1979–1999

A. K. Hilliard, J. K. Lovett and C. R. McGavin

2003

Hilliard, et al Occup Med 2003

Conclusion The reduction in incidence of mesothelioma is greater than can be accounted for by reduction in numbers of dockyard workers over the last 50 years. Changes in insulation materials and improved industrial hygiene measures introduced into the Devonport Dockyard from the mid-1960s have resulted in an earlier decline in the incidence of malignant mesothelioma than that predicted for the British workforce as a whole.

1999

British Journal of Cancer (1999) **79**(3/4), 666–672

Article no. bjoc.1998.0105

The European mesothelioma epidemic

J Peto[1,6], A Decarli[2,3], C La Vecchia[2,4], F Levi[5] and E Negri[4]

[1]Section of Epidemiology, The Institute of Cancer Research, Sutton, Surrey SM2 5NG, UK; [2]Istituto di Statistica Medica e Biometria, Universitá degli Studi di Milano, 20133 Milan, Italy; [3]Istituto per lo Studio e la Cura dei Tumori, 20133 Milan, Italy; [4]Istituto di Ricerche Farmacologiche 'Mario Negri', 20157 Milan, Italy; [5]Registre Vaudois des tumeurs, Institut Universitaire de Médecine Sociale et Préventive, CHUV-Falaises 1, CH-1011 Lausanne, Switzerland; [6]London School of Hygiene and Tropical Medicine, London WC1E 7HT, UK

Summary Projections for the period 1995–2029 suggest that the number of men dying from mesothelioma in Western Europe each year will almost double over the next 20 years, from 5000 in 1998 to about 9000 around 2018, and then decline, with a total of about a quarter of a million deaths over the next 35 years. The highest risk will be suffered by men born around 1945–50, of whom about 1 in 150 will die of mesothelioma. Asbestos use in Western Europe remained high until 1980, and substantial quantities are still used in several European countries. These projections are based on the fit of a simple age and birth cohort model to male pleural cancer mortality from 1970 to 1989 for six countries (Britain, France, Germany, Italy, The Netherlands and Switzerland) which together account for three-quarters of the population of Western Europe. The model was tested by comparing observed and predicted numbers of deaths for the period 1990–94. The ratio of mesothelioma to recorded pleural cancer mortality has been 1.6:1 in Britain but was assumed to be 1:1 in other countries.

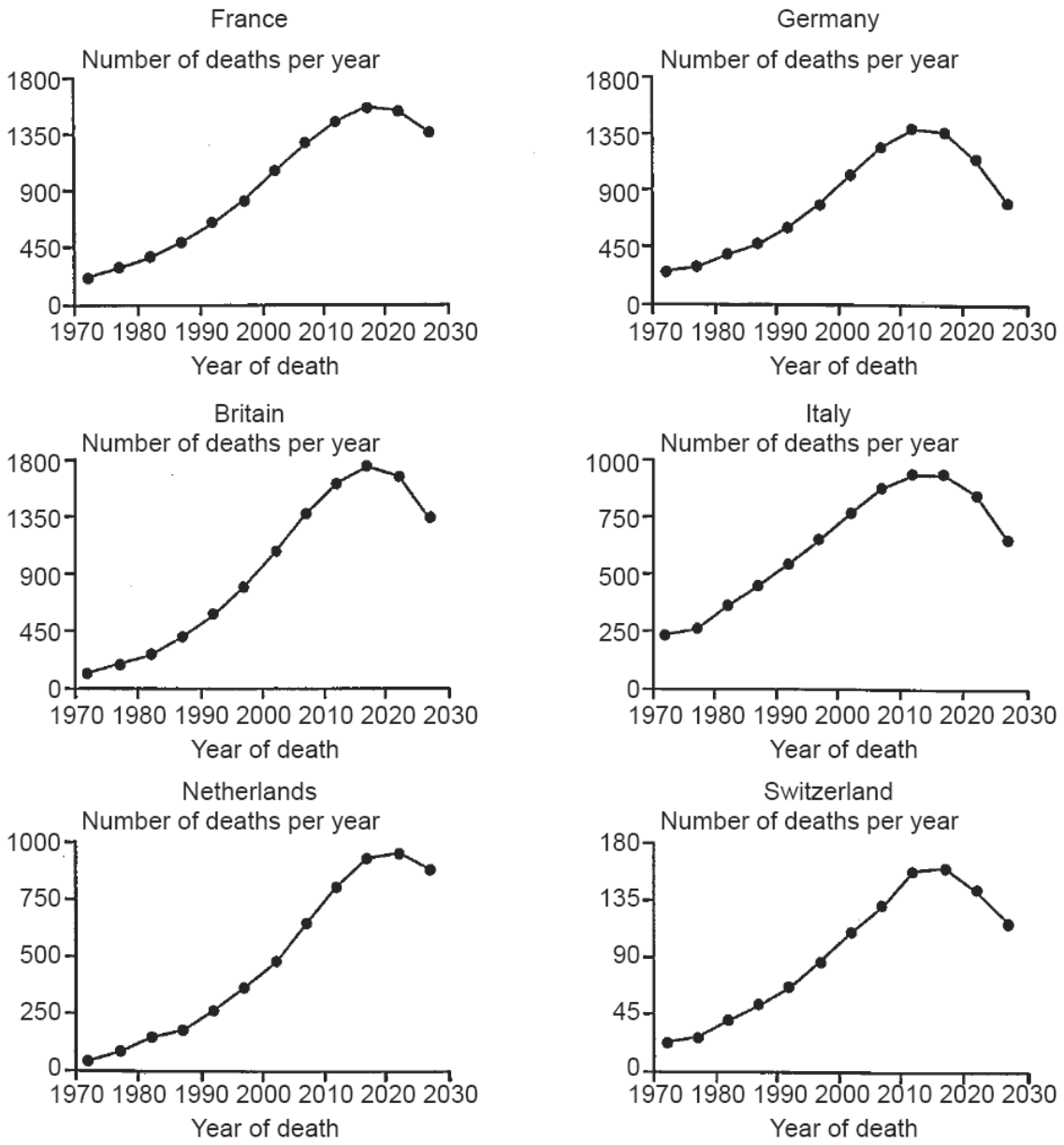


Figure 2 Observed (to 1989) and predicted (1990–2029) annual numbers of pleural cancer deaths in men in six Western European countries

2004

Short Communication

The Mesothelioma epidemic in Western Europe: an update

C Pelucchi*[,1], M Malvezzi[1], C La Vecchia[1,2], F Levi[3], A Decarli[4] and E Negri[1]

[1]Istituto di Ricerche Farmacologiche 'Mario Negri', Via Eritrea 62, Milano 20157, Italy; [2]Istituto di Statistica Medica e Biometria, Università degli Studi di Milano, Milano 20133, Italy; [3]Institut Universitaire de Médecine Sociale et Préventive, Bugnon 17, Lausanne 1005, Switzerland; [4]Dipartimento di Scienze Biomediche e Biotecnologie, Sezione di Statistica Medica Università degli Studi di Brescia, Brescia 25123, Italy

The number of male deaths from pleural cancer in France, Germany and Italy increased from about 8750 in 1990–1994 to 9550 in 1995–1999, suggesting that mesothelioma deaths in males may be levelling off in most of Western Europe.

British Journal of Cancer (2004) **90,** 1022–1024. doi:10.1038/sj.bjc.6601638 www.bjcancer.com

"It appears therefore that our models have overestimated the number of mesothelioma deaths in men."

"... the number of asbestos-related mesothelioma deaths during 1995–2029 in Europe is likely to be lower than the 250 000 previously estimated on data available up to 1994."

Pleural mesothelioma incidence in Europe: evidence of some deceleration in the increasing trends (IARC)

Cancer Causes & Control. 14(8):791-803, October **2003**.

Conclusions: While mesothelioma incidence rates are still rising in Europe, a deceleration has started in some countries. **A decrease may begin in the next few years in certain European populations** considering the deceleration of observed trends in mesothelioma and asbestos exposure, as well as the recent ban on its use.

Malignant Mesothelioma in Australia, 1945–2000

James Leigh, MB, BS, MA, MSc, MD, PhD,[1]* Patricia Davidson,[1]
Leigh Hendrie, BA, MPH,[2] and Dale Berry[2]

Conclusions *Australia's high incidence of mesothelioma is related to high past asbestos use, of all fiber types, in a wide variety of occupational and environmental settings. The number of cases in total is expected to be about 18,000 by 2020, with about 11,000 yet to appear.* Am. J. Ind. Med. 41:188–201, 2002. © *2002 Wiley-Liss, Inc.*

2002

Australian Asbestos Consumption

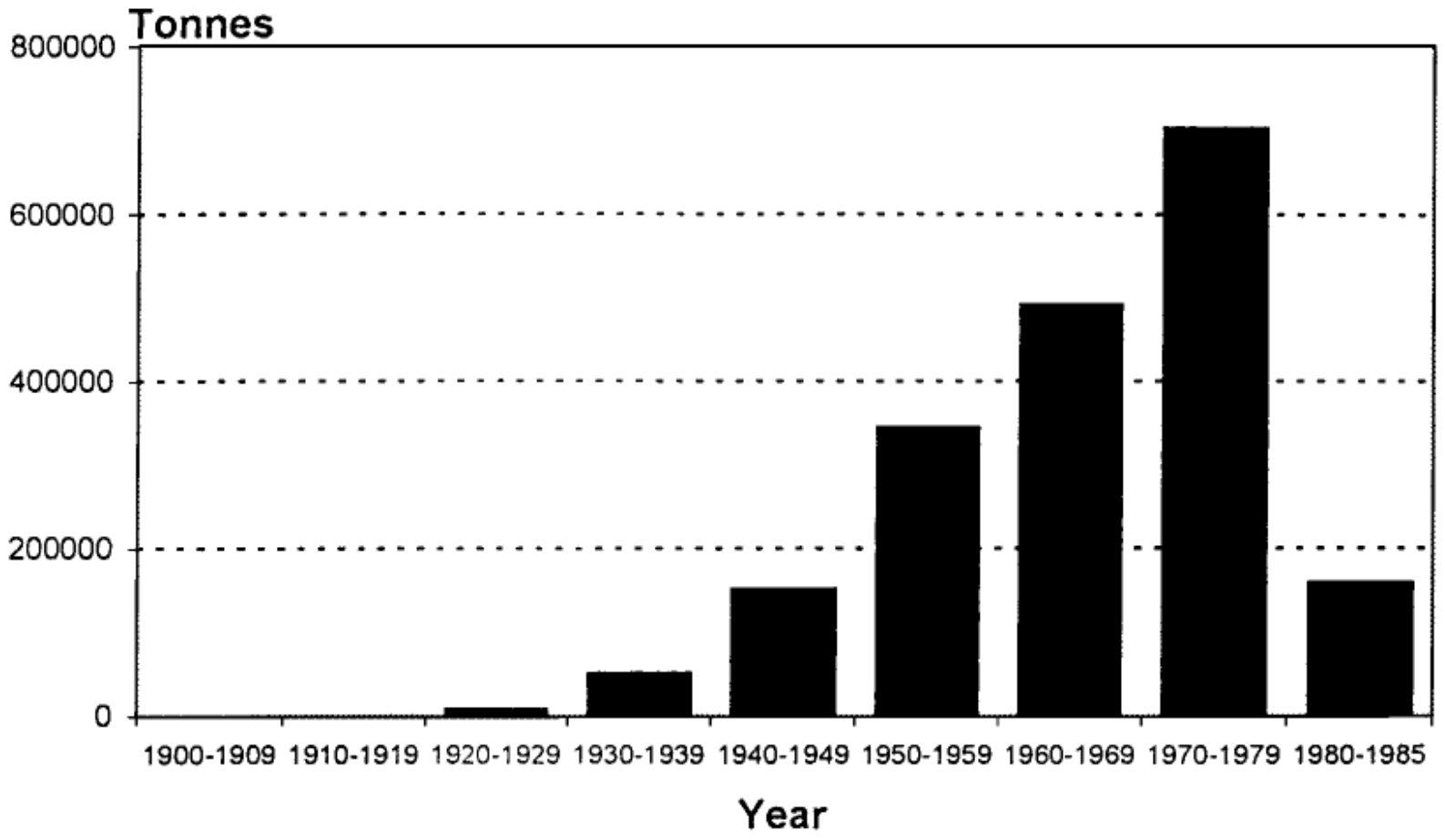


FIGURE 1. Asbestos consumption in Australia (1900–1985).

Australian Mesothelioma Register Notification

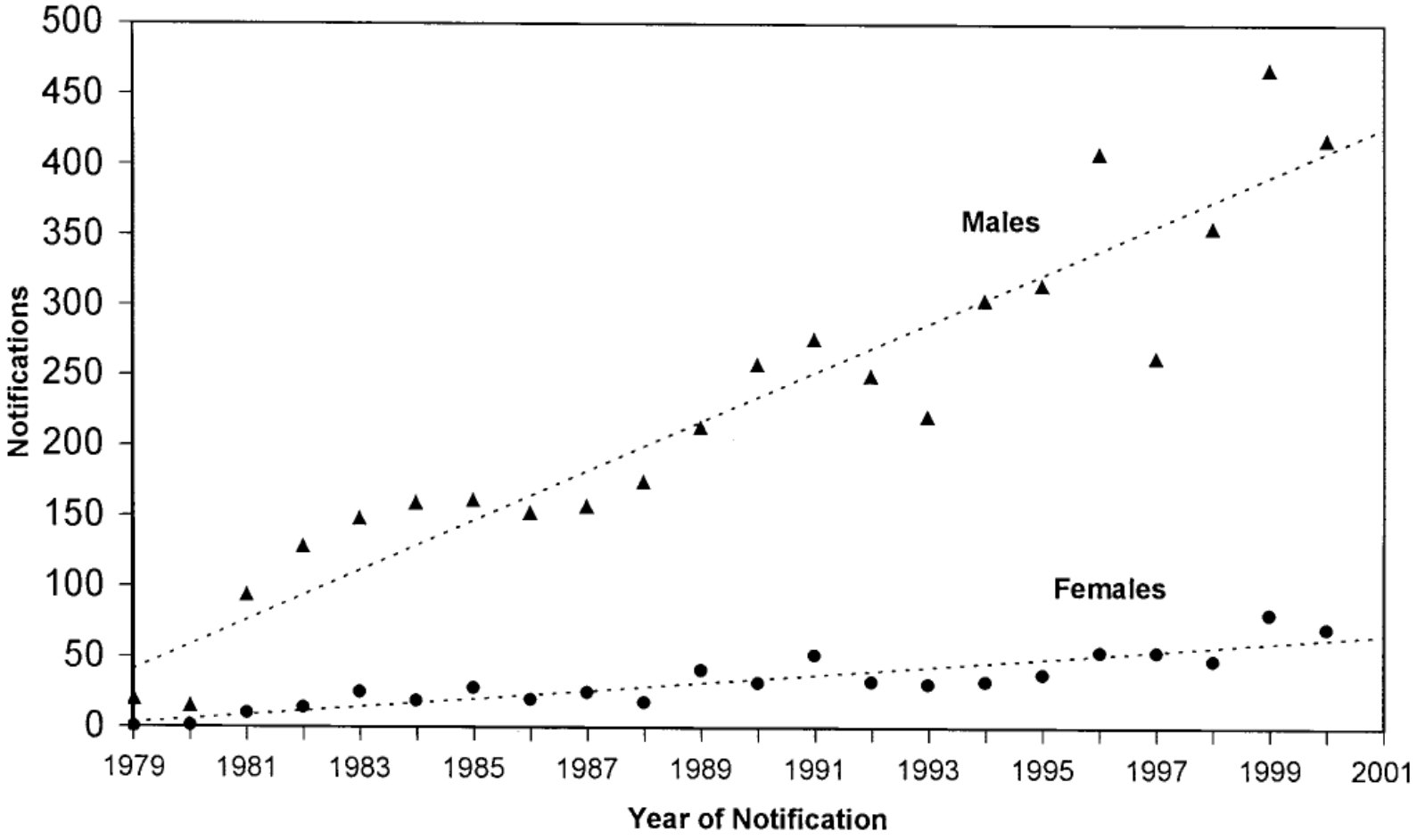


FIGURE 2. Australian Mesothelioma Register Notifications (1979–2000) (by sex).

Australian Mesothelioma Incidence & Projections

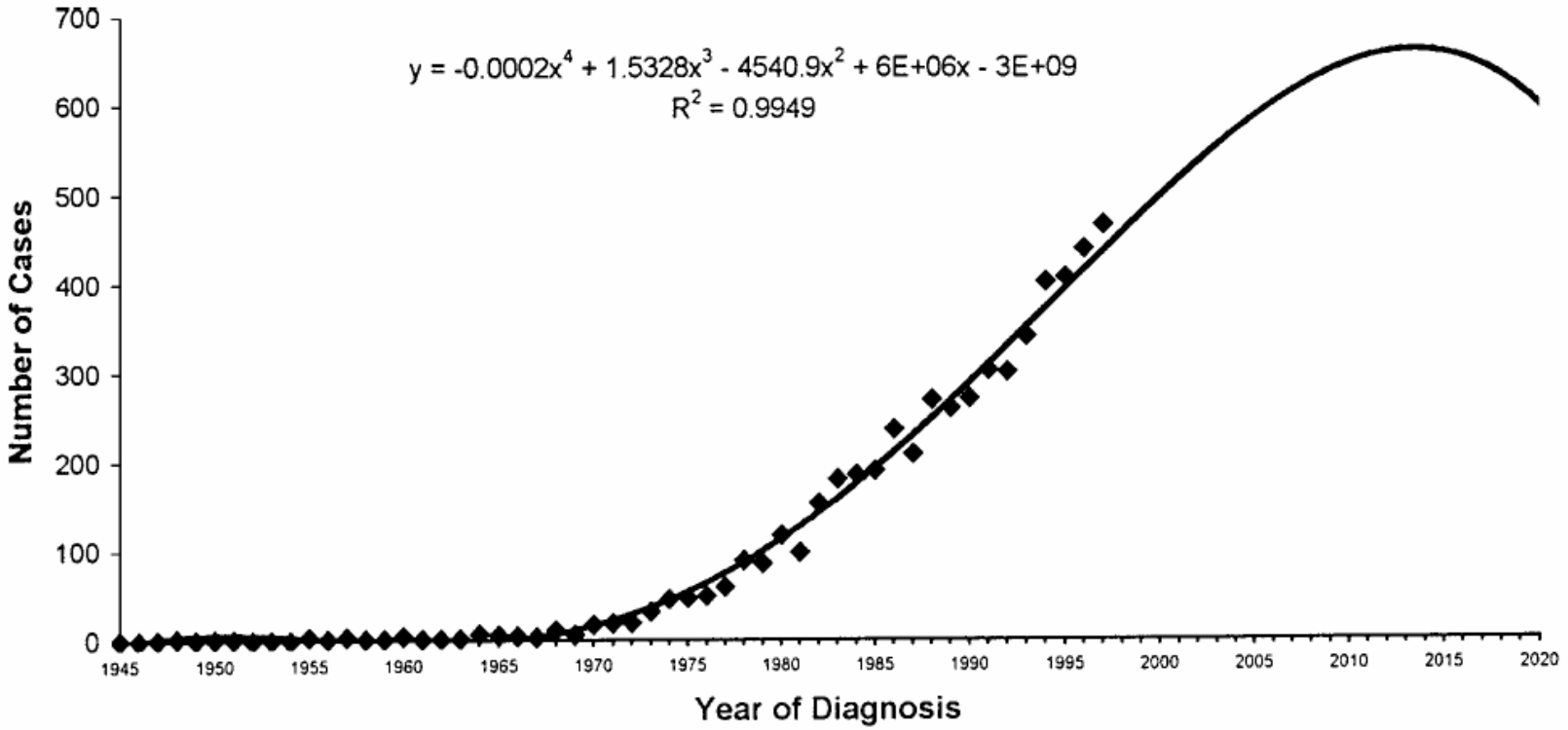


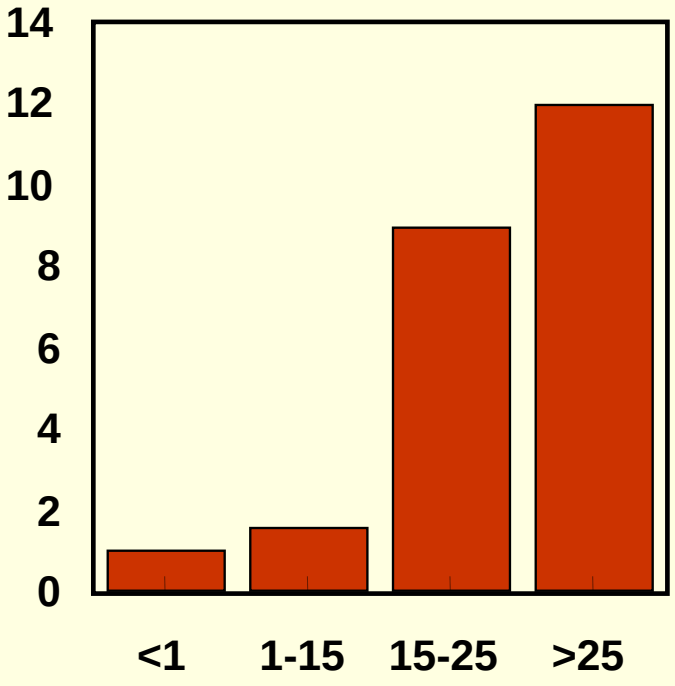
FIGURE 8. Incident cases of malignant mesothelioma in Australia (1945–1997) and extrapolation to 2020 assuming maximum at 2010.

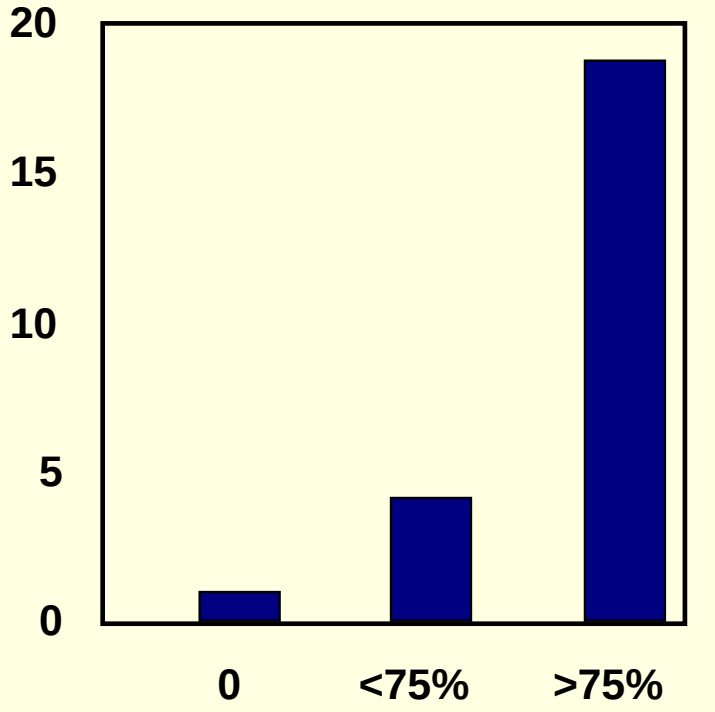
Mesothelioma and Fiber Type

Effect of Asbestos Exposure Duration and Fiber Type on Mesothelioma Risk

Hughes, Weill & Hammad Brit J Indust Med 1987; 44:161-174

Mesothelioma Odds Ratio





Asbestos Exposure—Quantitative Assessment of Risk[1-3]

JANET M. HUGHES and HANS WEILL[4]

AM REV RESPIR DIS 1986; 133: 5-13

Mesothelioma Risk for Occupational Cohorts Exposed to Different Types of Asbestos Fibers

TABLE 1

MESOTHELIOMA IN POPULATIONS EXPOSED TO DIFFERENT FIBER TYPES

Fiber Type	Total Deaths Observed	Lung Cancer		Mesothelioma	
		Observed Number	Excess*	Observed Number	As % of Excess Lung Cancer
Chrysotile (11, 15, 16, 27–30)†	5,500	407	99.0	12	12.1
Amosite (31, 32)	861	144	85.5	19	22.2
Crocidolite (33–35)	735	80	31.5	52	165.1
Mixed fiber (12, 14, 22, 29, 36–40)	6,751	960	485.3	320	65.9

* Studies combined. For each study, excess lung cancers = observed number minus number expected based on comparison population.

† References in parentheses.

Hughes & Weill 1986

Pergamon

Ann. occup. Hyg., Vol. 44, No. 8, pp. 565–601, 2000

Published by Elsevier Science Ltd on behalf of British Occupational Hygiene Society

0003-4878/00/$20.00

PII: S0003-4878(00)00045-4

The Quantitative Risks of Mesothelioma and Lung Cancer in Relation to Asbestos Exposure

JOHN T. HODGSON* and ANDREW DARNTON

Epidemiology and Medical Statistics Unit, Health and Safety Executive, Magdalen House, Stanley Precinct, Bootle L20 3QZ, UK

2000

Exposure-specific mesothelioma mortality (R_M) by Fiber type Groupings

Hodgson & Darnton (cont.)

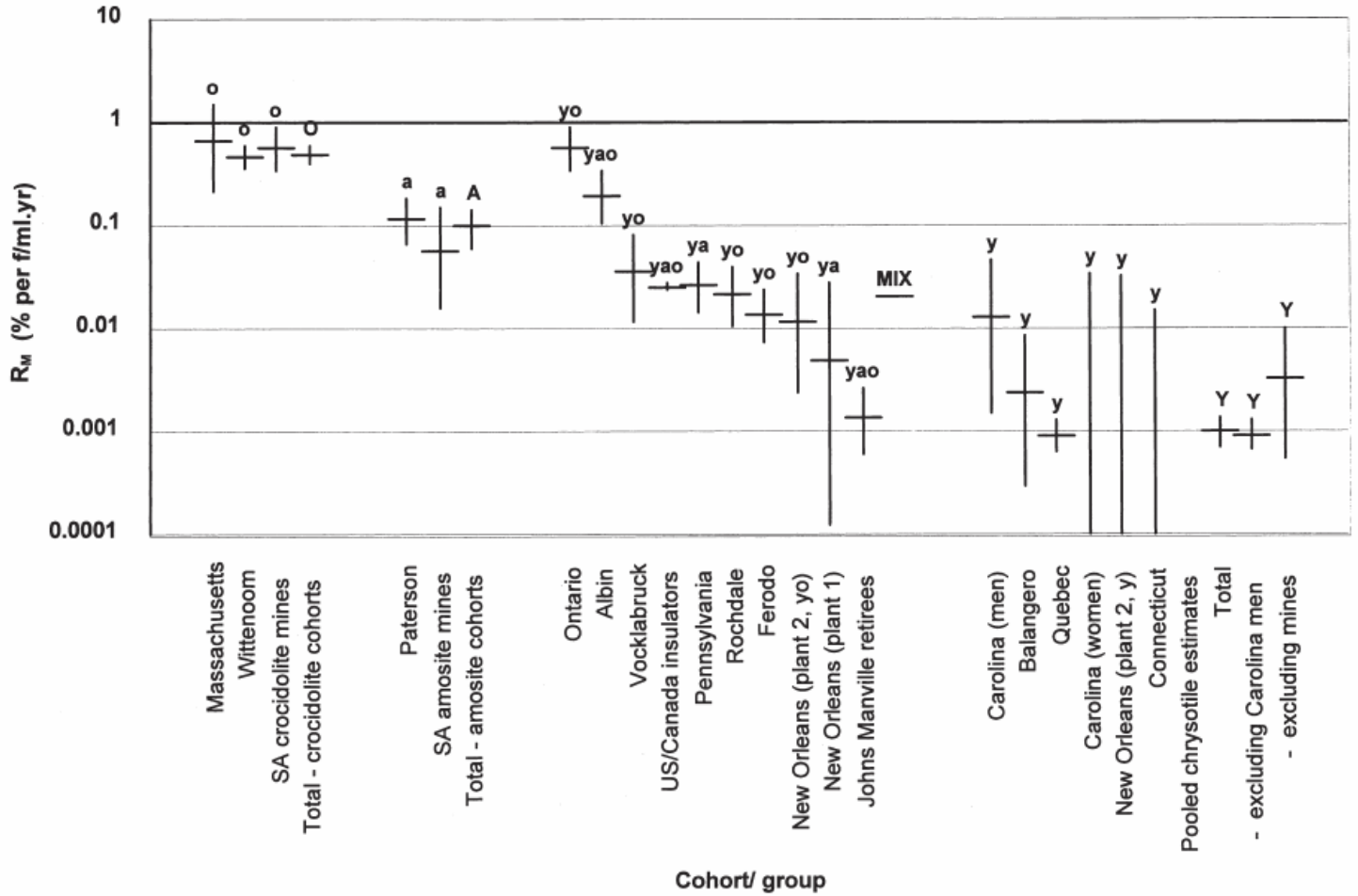


Fig. 2. Exposure-specific mesothelioma mortality (R_M) by cohort and fibre type groupings, showing 95% confidence intervals. Group means labelled in capitals. Confidence intervals not shown for groups with very significant heterogeneity.

Hodgson & Darnton (cont.)

"The [mesothelioma risk] estimates from the pure fibre cohorts suggest:

- **A difference in potency approaching two orders of magnitude between chrysotile and amosite,**

- **And a further five-fold difference between amosite and crocidolite.**

If these gross differences are even approximately correct, quite small variations in the fibre mix in the cohorts exposed to several fibre types could have important effects on the mesothelioma risk in the cohort."

Summary

- Incidence of mesothelioma has peaked in the U.S. and should continue on a downward course.
- Mesothelioma incidence in the U.K., Europe, and Australia is still increasing, but in a number of these countries, the rise has decelerated and a downward trend is expected in the next few years.
- The preponderance of epidemiologic evidence has now removed all doubt that most mesotheliomas are causally related to amphibole exposure.

Note: This presentation was prepared for oral delivery at the International Conference on Chrysotile in Montreal, May 23, 2006. This copy is for the use of meeting organizers, participants and audience and is not to be otherwise distributed or published, except with the permission of the author.