BJC OPEN

British Journal of Cancer (2012) 107, S1–S2

www.bjcancer.com

Foreword

Estimating the burden of occupational cancer as a strategic step to prevention

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British Journal of Cancer (2012) **107,** S1–S2; doi:10.1038/bjc.2012.135 www.bjcancer.com

Despite controversies about the accuracy of quantitative estimates there seems to be a broad consensus that occupational cancer 'tends to be concentrated among relatively small groups of people among whom the risk of developing the disease may be quite large, and such risks can usually be reduced or even eliminated, once they have been identified. The detection of occupational hazards should therefore have a higher priority in any programme of cancer prevention than their proportional importance might suggest (Doll and Peto, 1981). Moreover, low risk experienced by large numbers of workers exposed at low levels can also contribute substantially to an overall burden of cancer.

To pursue this aim, the British Health and Safety Executive (HSE) initiated a strategic approach to reduce the incidence of occupational cancer in Great Britain and to determine priorities for preventing occupational cancer based on sound evidence. To this end, Rushton *et al* (2010) at Imperial College London, the Institute of Occupational Medicine, the Institute of Environment and Health and the Health and Safety Laboratory carried out a comprehensive estimate of the burden of occupational cancer in Britain.

As part of this project two HSE-sponsored workshops were held in November 2004 and June 2006 that brought together national and international experts to discuss the issues relevant to the project and to advise on the appropriate methodology and data requirements. Many of the participants from the two workshops contributed advice throughout the project, particularly regarding selection of appropriate risk estimates and allocation of exposure levels to industry sectors. Earlier results of this project by Rushton *et al* (2008) have now been updated and extended, based on incidence in Britain in 2004 and mortality in 2005 (Rushton *et al*, 2010).

One of the major strengths of this project is its rigorous methodology coupled with full transparency in the approach. Briefly, Rushton *et al* estimated attributable fractions and numbers for incidence and mortality for agents and occupations classified as Group 1 or 2A carcinogens by the International Agency for Research on Cancer (IARC) Monographs programme with 'sufficient' or 'limited' evidence for specific cancers in humans. Risk estimates for low and high exposures were obtained from published literature and de novo meta-analyses taking into account validity of the studies and their relevance to the UK. National data sources (UK-CAREX (CARcinogen Exposure Database), the annual Labour Force Survey (LFS) and the Census of Employment) were used for estimating the proportion of the population exposed taking into account risk exposure periods (REP), assuming a latency of 10–50 years for solid tumours and 0–20 years for haematopoietic neoplasms. LFS data were also used to account for employment turnover and changes in numbers employed in the different industry sectors and occupations. Attributable fractions for mesothelioma were derived directly from several UK studies that suggested that between 85 and 90% of male mesothelioma cases are due to occupational exposure, and a ratio of 1 : 1 for mesothelioma to lung cancer deaths has been used for the estimation of lung cancers attributable to asbestos.

This project also had to face several important methodological challenges, particularly lack of or uncertainties about historical exposure prevalences and levels, and the choice of the most appropriate relative risks for low and high exposures during the REP.

The major findings are:

1. more than 8% of all cancer deaths in men are due to occupational exposures, and for lung cancer, the most important occupational cancer, the estimate for men is above 20%;
2. several of the most important occupational carcinogens are relevant beyond the workplace resulting in household (e.g., asbestos) and environmental exposures (e,g., diesel engine exhaust);
3. the evidence on occupational carcinogenic hazards is still incomplete and newly identified occupational carcinogens, including ones beyond the typical chemical carcinogens, may contribute additional substantial burden, particularly if exposures are widespread and affected cancer sites are common, even if the strength of association is only moderate (e.g., shift-work that involves circadian disruption leading to female breast cancer).

There are many more carcinogens classified as IARC Group 2B than Groups 1 and 2A combined (IARC, 2012), including many with potential occupational exposure and other exposures not yet evaluated by IARC and perhaps not immediately recognised as potential occupational carcinogens (e.g., sedentary work and colorectal cancer). These, together with the Group 2A carcinogens and sites with 'limited evidence' are obvious priorities for additional research and amongst those prioritisation can also be guided by the estimated burden.

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The results should help the HSE develop an evidence-based approach for occupational cancer control. With lung cancer as the most important occupational cancer and treatment outcomes for this cancer still being very poor and the effectiveness of lung cancer screening in the occupational setting still debated, primary prevention remains the best tool to reduce occupational lung cancer mortality. The use and manufacture of asbestos, historically the most important occupational carcinogen, has been strictly reduced in the UK since the 1970s. In the past, asbestos exposure occurred within industries such as shipbuilding, railway engineering and asbestos product manufacture. Workers with the highest risks today are likely to be those subject to incidental exposures during the course of their work, for example, building maintenance workers. Because of the long latency, the peak of asbestos-related cancers is still to come (Tan *et al*, 2010). This example may also help to understand why there are so few studies directly showing successful reduction of occupational cancer following effective intervention. However, given the robust evidence on the carcinogenic hazard of these exposures, monitoring progress is probably best achieved by monitoring exposure prevalence and levels. In this context, results of an analysis of the HSE National Exposure Database showing that for 12 of the top 19 carcinogens (Cherrie *et al*, 2007) the average exposure levels between 1986 and 2001 were above the current British occupational exposure limit are alarming and the new strategic initiative by HSE is both appreciated and needed.

Because of its sophisticated and rigorous methods the approach presented here in detail by Rushton *et al* has already led to similar projects in other countries (Järvholm *et al*, 2012) and is being adapted for the estimation of the global burden of occupational cancer. An updated, refined and expanded CAREX database would be instrumental in demonstrating progress towards controlling occupational cancer in the UK and worldwide although this would need to be continuously updated to ensure the currency of the data on prevalences and levels of exposure to carcinogens.

Conflict of interest

The author declares no conflict of interest.

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