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Health and Safety Executive

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Occupational Cancer statistics in Great Britain, 2019

Contents

Summary

The information in this document relates to Health and safety statistics for 2018/19. The document can be found at: http://www.hse.gov.uk/statistics/causdis/cancer.pdf

Many work and non-work related factors can cause cancer. Furthermore, cancer cases often present themselves many years after the relevant exposure took place. Therefore, it is usually difficult to know whether workplace exposures have caused particular cases of cancer. However, for a large population the approximate number of cancer cases where workplace exposures contributed can be estimated: in other words, how many current cases would not have occurred if the workplace exposure had not happened.

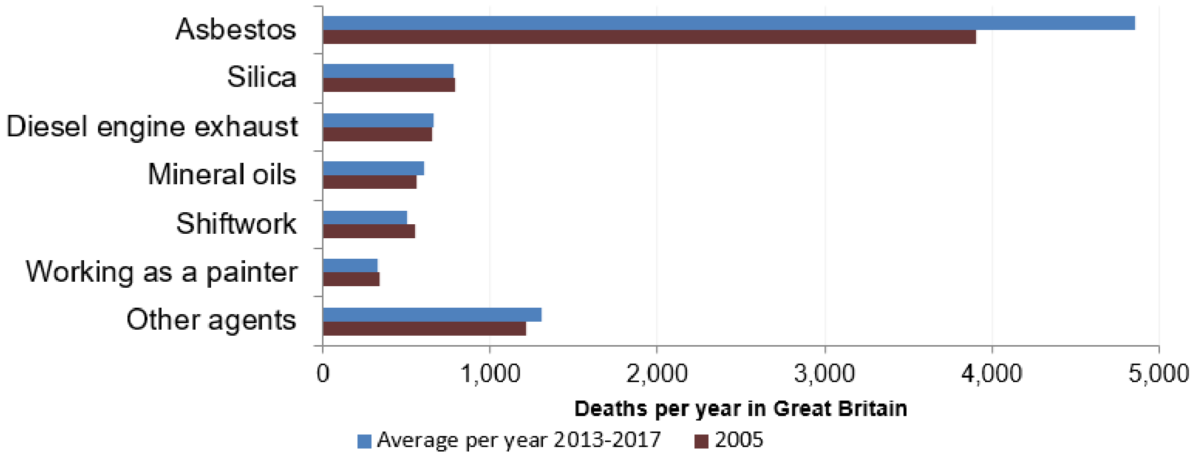
A research study on the burden of occupational cancer in Great Britain estimated the proportion of annual new cancer cases and deaths in Great Britain where workplace exposures contributed. This was done by looking at the likely number of workers who had past exposures to cancer causing agents and the risk of cancer from these exposures. In the original study, the estimated work-related proportions were applied to the national cancer statistics in 2004 for registrations (newly diagnosed cases), and in 2005 for cancer deaths to estimate the annual burden of occupational cancer. In 2019, we updated these estimates by applying the previous estimates of the work-related proportions to the newly available national cancer statistics (annual average deaths during 2013-2017 and cancer registrations during 2012-2016).

The researchers have also developed methods to estimate the number of occupational cancer cases in the future for a range of intervention scenarios. This will enable us to compare the potential impacts of these interventions on occupational cancer reduction. No update has been made for the future burden of occupational cancer because we do not have updated information on carcinogen exposure.

Further information on occupational cancer burden research can be found at: www.hse.gov.uk/cancer/research.htm

- Key points
  - Past occupational exposure to known and probable carcinogens is estimated to account for about 5% of cancer deaths in 2005 and 4% of cancer registrations in 2004 in Great Britain.
  - This equates to about 8,000 cancer deaths in 2005 and 13,500 new cancer registrations in 2004.
  - Past asbestos exposure is the leading cause of deaths from occupational cancer today. Other major causes of occupational cancer include past exposure to silica, solar radiation, mineral oils and shift work.
  - The construction industry has the largest estimate of occupational cancer cases, with about 3,500 cancer deaths in 2005 and 5,500 cancer registrations in 2004 from this industry.
  - Exposure to silica, diesel engine exhaust, solar radiation, shift work and working as painters and welders might become the main causes of occupational cancer in the future, according to the estimate of the research study.

Figure 1: Estimated occupational cancer deaths by cause in Great Britain



These are based on many assumptions and subject to considerable uncertainty. Both known and probable occupational carcinogens have been included in the estimates.

Introduction

Cancer starts when abnormal cells in the body grow out of control. There are different types of body cells that can become abnormal and develop into different types of cancers. Many risk factors can cause cancer, including ageing, exposure to radiation, chemicals and other substances at work and in the environment, family history of cancer, and many behaviours and lifestyle factors such as tobacco smoking, poor diet, lack of physical activities and being overweight. Very often, it is difficult to assess the role of occupational exposure in the development of cancer. Furthermore, many cancer cases present themselves many years after the relevant exposures took place (usually at least 10, but in some cases over 35 years). This makes it particularly difficult to link individual cases of cancer to the associated work exposures. As a result, national cancer registrations and other data sources such as cancer cases reported by specialist physicians as part of the occupational ill health surveillance system, or cancer cases assessed for the Industrial Injuries Disablement Benefit (IIDB) scheme, do not allow an accurate assessment of the overall number of cancers that are occupational. However, it is possible to estimate the proportion of all cancer cases in a population that are due to work, and use this to estimate the number of occupational cancer cases currently occurring.

In 1981, in their report to the US Congress, Doll & Peto estimated that 4% of cancer deaths in the US were attributable to occupation[1]. For over 25 years since the report, this occupational proportion had been used as the basis to estimate the burden of occupational cancer in Great Britain. In order to obtain an updated estimate to inform the development and prioritisation of occupational cancer control, the Health and Safety Executive commissioned a research study in 2005 to estimate the burden of occupational cancer in Great Britain (GB). The study was led by Dr Lesley Rushton and experts from the Imperial College London, the Institute of Occupational Medicine, the Institute of Environment and Health, and the Health and Safety Laboratory (now HSE's Science and Research Centre).

The final burden estimates would be influenced by the criteria used to include the carcinogens in the analysis. The GB cancer burden study considered both the known (Group 1) and the probable (Group 2A) carcinogens classified by the International Agency for Research on Cancer (IARC)[2]. For example, the study included shift work, a probable carcinogen, even though its causal link to female breast cancer has not been confirmed. A recently published independent research study, commissioned and funded by HSE and conducted by the University of Oxford, concluded that "night shift work has little or no effect on breast cancer incidence"[3]. In June 2019, IARC re-evaluated the association between night-shift work and cancer. A greater number of relevant studies have become available since the last evaluation in 2007 but the evidence in humans is still limited. IARC continued to classify night-shift work as a probable human carcinogen (Group 2A). This means the evidence is suggestive but is not sufficient to confirm a causal relationship between night-shift work and cancer. However, in addition to female breast cancer, positive associations have also been observed between night-shift work and cancers of the prostate, colon and rectum, which are amongst the most common cancers in men.

Forty-one carcinogens relevant to occupational exposures in Great Britain were included in the burden estimates[4]. The study has also developed methods to estimate the possible number of occupational cancer cases in the future and to compare the potential impacts of different interventions on occupational cancer reduction[5]. The number of occupational cancers occurring now is the result of past exposures to cancer causing agents in the workplaces, whereas future cases of occupational cancer will be the consequences of current and future exposure situations.

Estimated cases of occupational cancer

Estimated current cases

The cancer burden estimates have shown that about 8,000 cancer deaths in 2005 and around 13,500 cancer registrations in 2004 in Great Britain could be attributed to past occupational exposure. These represented 5.3% (8.2% for men and 2.3% for women) of all cancer deaths in 2005 and 4.0% (5.7% for men and 2.1% for women) of all newly diagnosed cancers in 2004 in Great Britain national cancer statistics[6], see Table **CAN01A** (www.hse.gov.uk/statistics/tables/can01A.xlsx). This estimate has included both established (IARC Group 1) and probable (IARC Group 2A) carcinogens and has been used in most of the published results. However, if the estimate were restricted only to the established (IARC Group 1) carcinogens, the occupational attributable proportion would moderately reduce to 4% for all cancer deaths and 3.4% for all cancer registrations, see Table **CAN01B** (www.hse.gov.uk/statistics/tables/can01B.xlsx).

In 2019, we applied the previously estimated occupational proportions for each of the cancer sites, by male and female, to more recent national cancer statistics (annual average deaths during 2013-2017 and cancer registrations during 2012-2016) to produce an updated occupational cancer burden in Great Britain, see Table **CAN01A_new** (www.hse.gov.uk/statistics/tables/can01A_new.xlsx) for the updated burden estimates that included both known (IARC Group 1) and probable (IARC Group 2A) occupational carcinogens; and see Table **CAN01B_new** (www.hse.gov.uk/statistics/tables/can01B_new.xlsx) for the updated estimates that included only the known (IARC Group 1) occupational carcinogens. When comparing the recently updated estimates to the original estimates, there is an increase in the number of occupational cancer deaths (from 8,000 to 9,000) and in the number of occupational cancer registrations (from 13,600 to 17,600). It is important to note that these increases are a result of changes in the number of cancers in the general population (e.g. large increases in mesothelioma and lung cancer for deaths, and non-melanoma skin cancer registrations) rather than indicating any changes in the occupational contribution. This is because the recent update has only applied the estimated occupational proportions in the original research study to the latest national cancer statistics.

The original cancer burden study has shown that past occupational exposure to asbestos is the leading occupational carcinogen, accounting for around 4,000 deaths (2,000 of mesothelioma and 2,000 of lung cancer) in 2005, equivalent to around half of all occupational cancer deaths in 2005 and a third of occupational cancer registrations in 2004. However, asbestos-related cancer deaths have since increased by about 25% to around 5,000 per year: there are now around 2,500 annual deaths from mesothelioma (one of the few kinds of cancer where deaths can be directly counted) and a similar number of lung cancers estimated to be due to past asbestos exposure several decades ago. The latest projections suggest that there will continue to be around 2,500 mesothelioma deaths per year for the rest of this current decade before annual numbers begin to decline.

Other major occupational carcinogens include silica, diesel engine exhausts (DEEs), mineral oils in terms of their contribution to cancer deaths (Figure 1); and shift working, mineral oils and solar radiation in terms of their contribution to cancer registrations[6], see Tables **CAN02** (www.hse.gov.uk/statistics/tables/can02.xlsx) for occupational cancer deaths, and Table **CAN03** (www.hse.gov.uk/statistics/tables/can03.xlsx) for occupational cancer registrations. The recently occupational cancer burden update in 2019, using the latest national cancer statistics, has presented a similar picture, see the corresponding Table **CAN02_new** (www.hse.gov.uk/statistics/tables/can02_new.xlsx), and Table **CAN03_new** (www.hse.gov.uk/statistics/tables/can03_new.xlsx).

Of all industry sectors, exposures in the construction industry accounted for the largest proportion (over 40%) of the occupational cancer deaths in 2005 and cancer registrations in 2004. In total, about 3,500 cancer registrations in 2004 in this industry are attributed to the past exposure to asbestos and silica, mostly causing lung cancer and mesothelioma. An additional 1,300 cancer registrations in 2004 in this industry are attributed to solar radiation, coal tars and pitches, mostly causing non-melanoma skin cancer (NMSCs), see Tables **CAN04** (www.hse.gov.uk/statistics/tables/can04.xlsx) for occupational cancer deaths, and Table **CAN05** (www.hse.gov.uk/statistics/tables/can05.xlsx) for occupational cancer registrations. We are not currently able to produce an update of the estimated occupational cancer burden by industry sector because we have neither the relevant national cancer statistics by industry sector nor updated carcinogen exposure data for these industries to enable the calculation.

Estimated future cases

Estimates of the current burden can only be a starting point for the consideration of priorities for prevention activity. The cancer burden research study has also developed methods to estimate the number of occupational cancer cases that may occur in the future based on what is known about the current exposed population, the exposure level and the associated risk of cancer, assuming that current exposure and employment trends continue without additional intervention to actively reduce particular risks[5]. Due to the lack of information on the current exposure situation and the uncertainties caused by the many assumptions used, it is difficult to know with any reliability the estimated number of occupational cancer cases in 2060. However, the statistical model that has been developed may allow us to test out the possible future impact of different intervention options. The research provides a framework for refining and improving these assessments in the light of new information about interventions and workplace exposures as it becomes available.

The results suggest that the number of occupational cancers associated with asbestos exposure may drop by more than 90% and the numbers associated with silica exposure are estimated to halve by 2060[7]. On the other hand, the numbers associated with diesel engine exhaust (DEE) are estimated to remain the same, and the numbers associated with solar radiation, shift work, polycyclic aromatic hydrocarbons (PAHs) and working as painters might increase.

A ranking of the estimated future cases attributed to the leading carcinogens by industry suggests that the construction industry will probably continue to account for the largest number of occupational cancer cases in the future, though the total number is estimated to reduce by a third by 2060, See Tables **CAN06** (www.hse.gov.uk/statistics/tables/can06.xlsx). Occupational exposures to silica, DEEs, solar radiation, shift work and working as painters and welders are estimated to become the main causes of occupational cancers in the future, see Tables **CAN07** (www.hse.gov.uk/statistics/tables/can07.xlsx).

Intervention scenarios have been used to test out their possible impact on reducing occupational cancer cases in the research study, see Tables **CAN08** (www.hse.gov.uk/statistics/tables/can08.xlsx). However, the interventions tested, for example lowering exposure standards, have demonstrated only limited impacts on further reducing the number of cancer cases associated with asbestos and DEEs. This is because the research study estimates that most of the future occupational cancers due to these causes will be attributed to large numbers of exposed workers at low levels of exposure[7].

The study to estimate the future occupational cancer cases included only the 14 leading carcinogens and work activities that contributed more than 100 occupational cancer registrations per year. Together, they account for 86% of the total number of occupational cancer cases currently occurring. Other carcinogens, including mineral oils, chromium VI, wood dust, benzene and rubber manufacturing, were not included in the estimate, but are potentially important for cancer prevention.

The number of future cases is estimated based on the assumptions that the current trends of exposure and employment will continue up to 2030 and remain constant thereafter. The estimate is a combined effect of predicted falling occupational exposures, which largely contributes to the reduction of the overall cancer numbers, and the ageing population and population growth, which, on the other hand, contribute to the rising cancer numbers. The future burden estimation did not consider the potential impacts of lifestyle changes on cancer risk in the population[5].

The estimated figures on the current and future number of occupational cancers should be used with care because they are based on many assumptions and subject to considerable uncertainty[8]. The model to estimate future cases may be more useful for comparing the effects of different interventions for particular carcinogens rather than across different carcinogens. The major sources of uncertainty in estimating the occupational cancer cases include: the choices of risk estimates from literature for an occupational exposure, the imprecision of the risk estimates, the misclassification of workers in different exposure categories, the lack of reliable information on both the exposure levels and the exposure trends in the GB workforce.

Known carcinogens

The International Agency for Research on Cancer (IARC) is part of the World Health Organization. IARC runs a monograph programme evaluating scientific evidence to identify if specific exposures are carcinogenic hazards to humans. The monographs published by IARC are recognised as an authoritative source of information on the carcinogenicity of a wide range of human exposures, including chemicals, complex mixtures, occupational exposures, physical and biological agents and lifestyle factors.

Since 1971, the carcinogenicity of more than 1000 agents has been evaluated. According to the updated information published by IARC in September 2019[2],

- 120 agents have been identified as carcinogenic to humans (IARC Group 1)
- 82 agents were probably carcinogenic to humans (IARC Group 2A), and
- 311 agents were possibly carcinogenic to humans (IARC Group 2B).

The IARC categories of Group 1, 2A and 2B are to measure the strength of the evidence of an association whether an agent is carcinogenic to humans. IARC Group 1 is the highest category of evidence that is sufficient to establish a causal relationship between an exposure and the development of cancer. These categories, however, do not indicate the level of the cancer risk of an agent. For example, the term "probably" carcinogenic represents a higher level of evidence of human carcinogenicity than the term "possibly".

Not all carcinogens are relevant to occupational exposure. To define an occupational carcinogen requires additional evidence on workplace exposure of the agent and on carcinogenic effects of the agent in exposed workers. IARC has recently developed an updated list of 47 occupational carcinogens, following the review of Group 1 carcinogens identified in 1971-2017[9]. This was compared to a list of 28 occupational carcinogens published by Siemiatycki et al in 2004[4] and a list of 16 published by Doll and Peto in 1981[1]. The observed increase in the number of occupational carcinogens identified will be more likely due to the improvements in the identification process, facilitated by the advances in scientific research, rather than due to the increase in workplace exposure. It is important to note that many workplace exposures have not been evaluated for their carcinogenic potential. New agents are introduced into the workplaces much faster than the occupational carcinogen evaluation process. IARC gives priority to evaluating the agents that are known to have human exposure and have scientific evidence to indicate their health effects. Furthermore, for the over 1000 agents evaluated by IARC, most of them did not have adequate evidence to suggest they could be carcinogenic to humans.

There are methodological differences in defining occupational carcinogens. The latest IARC list of 47 occupational carcinogens has only included Group 1 carcinogens that have sufficient evidence from studies in exposed workers. However, this list excluded Group 1 carcinogenic processes (e.g. iron and steel founding), carcinogenic industries (e.g. rubber manufacturing), and carcinogenic occupational groups (e.g. working as a painter) where specific carcinogenic agents could not be identified. On the other hand, the HSE occupational cancer burden study has included 41 carcinogens that were relevant to occupational exposures in Great Britain between 1955 and 2005. These included 26 of the 47 in the recent IARC list of occupational carcinogens. Unlike the IARC list, the HSE cancer burden study included IARC Group 1 carcinogenic processes, industries and occupational groups, as well as some of the IARC Group 2A (probable) human carcinogens, including shift work, hairdressers and barbers, petroleum refining, inorganic lead and tetrachloroethylene.

Other statistical information on occupational cancers

Number of occupational cancers compensated under the Industrial Injuries Disablement Benefit (IIDB) scheme

There are specific forms of occupational cancer that are currently compensable under the Department for Work and Pensions Industrial Injuries and Disablement Benefit (IIDB) scheme [10]. The numbers of people who have been compensated in the past 10 years (2009-2018) are presented in IIDB tables (www.hse.gov.uk/statistics/tables/index.htm#iidb).

On average, 2,354 new occupational cancer cases per year were compensated over the last 10 years, which was just under a quarter of the total cases compensated. The majority of the occupational cancer cases were asbestos-related. These include mesothelioma (about 2,080 per year on average and 2,230 in 2018, with 11% female), and asbestos-related lung cancer (271 per year on average and 200 in 2018, with only 2% female). The number of people compensated for non-asbestos-related cancers was much lower at 18 cases per year on average and 5 cases in 2018. Among them, the most frequently compensated cancer was urinary tract cancer associated with workplace exposure to various chemicals[10].

Number of occupational cancers reported by consultant chest physicians and dermatologists

Specialist physicians in the UK have been reporting work-related ill health, including occupational cancer to The Health and Occupation Research Network (THOR http://research.bmh.manchester.ac.uk/epidemiology/COEH/research/thor/). The number of cases reported during 1998-2018 are presented in the THOR tables www.hse.gov.uk/statistics/tables/#thor.

In 2018, consultant chest physicians reported an estimated 329 cases of mesothelioma and 53 cases of lung cancer. The number of mesothelioma cases reported in 2018 was much lower than the annual average of around 640 cases in the past 21 years (1998-2018). These figures substantially underestimate current mesothelioma incidence and this is likely to be largely due to current referral practices which mean many cases are not seen by chest physicians.

Consultant dermatologists reported an annual average around 380 cases of skin cancer in the past 21 years but only reported 67 cases in 2018. Once again, there has been an observed decrease in the number of skin cancer cases reported by dermatologists since 2010. However, this may reflect systematic changes in the reporting system rather than trends in the cancer occurrence.

For most types of cancer, the number of occupational cases reported by physicians or assessed for compensation purposes is much lower than the estimates from the cancer burden study. This reflects the difficulty in attributing individual cases to occupational exposures. However, comparison of new cases across different data sources has indicated that the reporting and assessment of mesothelioma cases are more complete than other occupational cancer cases due to the strong work attribution of this disease.

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National Statistics

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An account of how the figures are used for statistical purposes can be found at www.hse.gov.uk/statistics/sources.htm.

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Additional data tables can be found at www.hse.gov.uk/statistics/tables/.

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