



Occupational mortality in England and Wales, 1991- 2000

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The statistical links between occupations and causes of death have been investigated in a report published by the Office for National Statistics (ONS) and the Health and Safety Executive (HSE). The report is part of a series published for 10 year periods in the form of Registrar General's Decennial Supplements and covers the period 1991-2000.

The research was carried out by a team at the University of Southampton MRC Epidemiology Resource Centre under Professor David Coggon and focuses on those combinations of occupation and cause of death which might be associated with known and postulated potential occupational hazards.

The results are purely statistical which means that they cannot prove a causal link between an occupation and a disease, providing only evidence of a statistical association, which may or may not support other evidence. It is recommended that anyone with an interest in a specific industry or hazard reads the full report, since the interpretation of any statistical linkage cannot be adequately discussed in this summary.

<http://www.statistics.gov.uk/StatBase/Product.asp?vlnk=1624>

The measure used in the analysis was the proportional mortality ratio (PMR). This measures the proportion of deaths occurring from a given cause for a particular occupation relative to the proportion of deaths from that cause in the whole population. A PMR of greater than 100 for a combination of occupation and cause of death shows that the proportion of all deaths to people formerly in that occupation arising from that cause is greater than the proportion of all deaths in all occupations combined, attributed to that cause of death. (See Methods below for more explanation of PMRs and their interpretation).

KEY POINTS FROM THE REPORT

The job groups accounting for the largest numbers of deaths of men from asbestos-related disease were carpenters, production fitters, electricians, plumbers and gas fitters, and certain groups of construction workers.

Coal miners had the highest mortality from other pneumoconiosis, but non-coal miners and quarry workers had the highest proportion of deaths from silicosis. This group also had a high proportion of deaths from tuberculosis, which is a recognised complication of silicosis.

There was high proportional mortality from almost all the causes of death associated with alcohol in both male and female publicans and bar staff, male caterers, cooks and kitchen porters and seafarers. This was a similar finding to that of the previous decennial supplement, covering the period 1979-90.

Sino-nasal cancer is a recognised hazard of occupational exposure to wood dust (especially dust from hardwoods used in the manufacture of furniture), dust from vegetable tanned leather (used to make the soles and heels of welted boots and shoes), and some nickel compounds. In addition, a link has been proposed with inhalation of textile dust^{6 7}. Relatively high PMRs were observed in carpenters, and especially in cabinet makers (who tend to work more with hardwoods than carpenters). There was also a significantly elevated PMR in female spinners and winders, but not in other textile jobs either in men or women. No clear excesses of mortality were apparent in leather and shoe workers, electroplaters or welders.

Aircraft flight deck officers, who had significantly elevated mortality from melanoma in 1979-90¹ again had high mortality from the disease. High rates of melanoma in pilots and aircrew have been reported in several other studies and some researchers have suggested that their exposure to cosmic radiation could be a contributing factor^{17 18 19}. Otherwise, the findings for skin melanoma do not point to occupational hazards.

Shift work²⁵ and work-related stress²⁶ have been suspected of contributing to occurrences of ischaemic heart disease, but no occupational hazard was suggested by the results. Recently, shift work has been associated with increased rates of breast cancer, but this analysis provides no support for those findings (see section on Other Cancers below).

There were significantly raised PMRs for pneumococcal and unspecified lobar pneumonia in sheet metal workers and welders who are exposed to metal fume. This pattern has been seen in analyses relating to earlier periods²⁸.

Among men, an estimated excess of approximately 1300 deaths over the 10 year period were associated with accidents that could reasonably be attributed to work, the largest contributing categories of accident being motor vehicle accidents (500 excess deaths), injury by machinery (117) and falls from buildings (96).

Among women, the excess mortality from injuries that were likely to be occupational was much smaller (52), the main contributions being from motor vehicle accidents (29 excess deaths). More than 4 per cent of the deaths occurring to female lorry drivers and other motor vehicle drivers at working age were accounted for by motor vehicle accidents.

Among both men and women, the occupations with highest mortality from suicide were in health-related occupations such as doctors, dentists, nurses and veterinarians. Male farmers also had high PMRs for suicide.

FURTHER RESULTS

Infectious Diseases

Blood-borne and sexually transmitted infections

Hairdressers and tailors and dressmakers had particularly high PMRs from HIV/AIDS/immunodeficiency, both with PMRs of 918. Several of the job groups with increased mortality from HIV/AIDS/immunodeficiency also had high PMRs for viral hepatitis, most notably literary and artistic occupations (PMR 249), caterers (PMR 387) and cooks and kitchen porters (PMR 511). Among women, increased mortality from HIV/AIDS/immunodeficiency was again seen in literary and artistic occupations (PMR 281), tailors and dressmakers (PMR 804), nurses (PMR 186) and there was also an excess of deaths in hospital porters and ward orderlies that fell just short of statistical significance (PMR 177). However, there was a deficit of deaths among female hairdressers (3 observed relative to 4.8 expected).

Blood-borne infectious diseases are an occupational hazard in certain jobs, especially in health care. However, most of the variation in mortality between job groups is likely to have been driven by non-occupational factors.

Disorders related to drugs

Abuse of drugs

The study reported high PMRs for drug-related deaths in literary and artistic occupations, also among labourers and several trades in the construction industry.

Other Cancers

Female reproductive cancers

These diseases include cancers of the breast, cervix, uterine body and ovary. Nurses had low PMRs for all four diseases. In tailors and dressmakers, the PMR for cancer of the uterine body was significantly less than 100 while those for breast and ovarian cancers were significantly elevated. In the last decennial supplement relating to the period 1979-1990, it was noted that female farmers had a significantly low PMR for breast cancer but a significantly high PMR for ovarian cancer¹. In the current analysis, this unusual pattern was repeated, although it was not quite so marked.

Cancer of the renal parenchyma

Job groups with significantly elevated PMRs for cancer of the renal parenchyma include several engineering occupations that entail exposure to machine oils, and possibly also to solvents. Among other occupations with high exposure to organic solvents, printers had relatively high mortality (80 deaths, PMR 123, 95% confidence interval 98-153), but painters had fewer deaths than expected from the disease (156 deaths, PMR 90, 95% confidence interval 77-106).

Lymphatic and haematopoietic cancer, aplastic anaemia and agranulocytosis

The last decennial analysis of occupational mortality drew attention to high PMRs from lymphatic and haematopoietic cancer in teachers, both in higher education and in schools.¹ However, a subsequent systematic review of the relevant published literature did not provide any clear support for an occupational hazard²¹. During 1991-2000, PMRs were again elevated for non-Hodgkin lymphoma and myeloma. However, this may, in part, be a spurious consequence of relatively low death rates among teachers from common causes such as coronary heart disease and lung cancer.

Farmers have previously been reported to have unusually high rates of non-Hodgkin lymphoma.²² In this analysis there were 487 deaths from non-Hodgkin lymphoma in male farmers (PMR 112, 95 per cent confidence interval 102-123), and 54 in female farmers (PMR 119, 95 per cent confidence interval 90-156).

Cardiovascular disease

Ischaemic heart disease

Ischaemic heart disease, which was the most common cause of death analysed, accounted for 29.1 per cent of all deaths in men, and 16.7 per cent of all deaths in women. PMRs for ischaemic heart disease tended to be high in male textile and clothing workers and this might be explained if these job groups included an unusually high proportion of immigrants from the Indian subcontinent

among whom ischaemic heart disease tends to be more common²⁷. The findings for ischaemic heart disease did not suggest any occupational hazards.

BACKGROUND NOTES

Sources of data

1. The analysis was based on all deaths in England and Wales during 1991-2000 at ages 16-74 years. For each death, information was extracted from the death certificate on the sex, age at death, underlying cause of death and last full-time occupation of the deceased. Causes of death were coded to the ninth revision of the International Classification of Diseases (ICD), and occupations to the Standard Occupational Classification 1990 (SOC 90)². Social class, classified to nine categories, was derived from the last full-time job according to a standard algorithm³.

Grouping of causes of death

2. For the purpose of this analysis, underlying causes of death were grouped into 226 categories. These diagnostic categories were chosen according to their known or potential relevance to occupational causation, and were almost identical to those analysed in the 1979-90 Decennial Supplement¹.

Grouping of occupations

3. Occupational codes were aggregated into 181 job groups, in a way that aimed to distinguish occupations that might differ importantly from each other in their exposures to work-related causes of mortality. Thus discrimination between manual occupations was more detailed than for office jobs, many of which were combined to form larger categories. The job groups defined were very similar to those examined in the 1979-90 Decennial Supplement, but modifications were required where the SOC 90 classification amalgamated some occupations that previously had been coded separately. Deaths for which no occupation was recorded or the job reported was inadequately described were excluded from further analysis. This left a total of 1,202,888 deaths in men and 408,152 deaths in women that were used to examine the relationship of occupation to cause of death.

Methods

4. Associations of cause of death with occupation were characterised by proportional mortality ratios (PMRs) with associated 95 per cent confidence intervals. A PMR is calculated as a ratio (expressed as a percentage) of total observed to expected numbers of deaths for the cause of death and job group of interest, where the expected number of deaths was derived as follows. For each five-year age group of mortality, the total number of deaths in the job group of interest

was multiplied by the proportion of all deaths that were from the relevant cause in all job groups combined, to give an age-specific expected number of deaths. These were then summed over the relevant age range to give a total 'expected' number of deaths for that combination of job group and cause of death. When expected deaths are calculated in this way, the ratio of observed to expected deaths gives an age-standardised PMR, which allows for differences in the age structure of deaths for different job groups. As well as age-standardising in this way, most PMRs were standardised also for social class. This is to reduce confounding by effects of non-occupational risk factors related to socio-economic position. An exception was made for the armed forces, which formed a separate social class category made up of just this job group. PMRs for the armed forces were adjusted only for age. Unless otherwise stated, the PMR's presented in this report are for ages 16-74 years. Exceptions were made for causes of death for which any impact of occupation was likely to be fairly immediate (for example, injuries). For these causes, PMRs are presented for deaths at normal working ages (16-64 years in men and 16-59 years in women).

5. Confidence intervals for PMRs were based on the Poisson distribution, and PMRs for which the 95 per cent confidence interval excluded 100 were deemed statistically significant.

Limitations of the analysis

Data on cause of death

6. The analysis was based on the underlying cause of death as recorded on the death certificate. It was therefore capable of providing little information about diseases that are rarely fatal. Moreover, where associations were found with diseases that do not consistently lead to death, the possibility must be considered that occupation was related not to development of the disease, but to whether the disease was fatal when it occurred. A further problem is that diagnoses as recorded on death certificates are not always accurate. Usually, errors in diagnosis would be expected to obscure true differences between occupations, but if, for example, diagnostic misclassification were geographically heterogeneous, it could give rise to spurious associations with occupations that were more common in those parts of the country where the diagnosis was more likely to be made.

Data on occupation

7. The occupational information that was used related to the deceased person's last full-time job. However, for deaths from chronic diseases, other jobs undertaken earlier in the decedent's career may sometimes have been more relevant. In addition, it has long been recognised that inaccuracies occur in the reporting of occupation on death certificates⁴. Sometimes the relative who registers the death does not give a sufficiently specific description of the job (for example, referring to a toolmaker as an engineer), and sometimes the status of the deceased person's job is inflated (such as a self-employed shopkeeper being reported as a company director).

Use of PMRs

8. Analysis was based on PMRs because no satisfactory data were available on the occupational populations at risk over the course of the study period, and therefore death rates by occupation could not be calculated. A disadvantage of the method used is that the PMR of a job group for a specific cause depends not only on its death rate from the cause in question, but also on its death rate from all causes combined. Thus, for example, teachers might have a high proportion of deaths from multiple sclerosis not because they are unusually susceptible to the disease, but because they do not die so frequently as other occupations from other causes of death. Spurious effects on PMRs of this type are particularly liable to occur where a job group differs importantly from the average in its mortality from the most common causes of death.

Chance findings

9. The analysis examined more than 40,000 combinations of cause of death and job group, and even if there were no underlying differences in mortality by occupation, many associations would be expected to achieve statistical significance simply by chance. Thus, when interpreting findings, it is important to consider the plausibility of associations in the context of what is known from earlier analyses and from other sources. *Most statistically significant associations that were found unexpectedly are likely to have occurred by chance.*
10. Details of the policy governing the release of new data are available from the media office.
11. National Statistics are produced to high professional standards set out in the Code of Practice for Official Statistics. They undergo regular quality assurance reviews to ensure that they meet customer needs. They are produced free from any political interference.
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References

1. Drever F (ed).(1995). *Occupational Health Decennial Supplement*. (Series DS no.10) London:HMSO.
2. Office of Population Censuses and Surveys (1990). *Standard Occupational Classification. Vol. 1. Structure and definition of major, minor and unit groups*. London: HMSO.
3. Office of Population Censuses and Surveys (1991). *Standard Occupational Classification. Vol. 3. Social classifications and coding methodology*. London: HMSO.
4. Office of Population Censuses and Surveys (1978). *Occupational mortality 1970-72. Decennial Supplement for England and Wales*. (Series DS no.1). London: HMSO.

5. Coggon D, Inskip H, Winter P, Pannett B (1995). Differences in occupational mortality from pleural cancer, peritoneal cancer and asbestosis. *Occup Environ Med* 1995;52:775-777.
6. Brinton LA, Blot WJ, Fraumeni JF Jr.(1985). Nasal cancer in the textile and clothing industries. *Br J Ind Med*; 42(7):469-474.
7. Luce D, Gerin M, Morcet JF, Leclerc A (1997). Sinonasal cancer and occupational exposure to textile dust. *Am J Ind Med* 1997; 32(3):205-210.
8. Rafnsson V, Hrafnkelsson J, Tulinius H (2000) Incidence of cancer among commercial airline pilots. *Occup Environ Med* ;57;175-179.
9. Pukkala E, Aspholm R, Auvinen A, Eliasch H, et al.(2002) Incidence of cancer among Nordic airline pilots over five decades: occupational cohort study. *BMJ*;325:567-571.
10. Hammar N, Linnarsjö A, Alfredsson L, Dammström B, Johansson M, Eliasch H (2002) Cancer incidence in airline and military pilots in Sweden 1961-1996. *Aviat Space Environ Med*;73:2-7.
11. Doll R, Peto R (1981). *The causes of cancer*. Oxford: OUP
12. Kelsey JL, Gammon MD, John EM (1993). Reproductive factors and breast cancer. *Epidemiol Rev*;15:36-47.
13. Cramer DW. (1982). Uterine cervix. In Schottenfeld D, Fraumeni JF (eds). *Cancer epidemiology and prevention*. Philadelphia: Saunders: 881-900.
14. Van Der Gulden JW, Vogelzang PF (1996). Farmers at risk for prostate cancer. *Br J Urol* 77:6-14.
15. Coggon D, Inskip H, Winter P, Pannett B. (1996) Mortality from scrotal cancer in metal machinists in England and Wales, 1979-80 and 1982-90. *Occup Med*;46: 69-70.
16. Lipworth L, Tarone RE, McLaughlin JK.(2006) The epidemiology of renal cell cancer. *J Urol*;176:2353-2358.
17. Savitz DA (1995) Overview of occupational exposure to electric and magnetic fields and cancer: advancements in exposure assessment. *Environ Health Perspect*;103 suppl 2;69-74.
18. Descatha A, Jenabian A, Conso F, Ameille J (2005) Occupational exposures and haematological malignancies: overview on human recent data. *Cancer Causes Control*;16: 939-953.
19. Smith MT (1996) Overview of benzene-induced aplastic anaemia. *Eur J Haematol Suppl*; 60:107-110.

20. Pyatt D (2004). Benzene and hematopoietic malignancies. *Clin Occup Environ Med*; 4:529-555.
21. Baker P, Inskip H, Coggon D (1999). Lymphatic and hematopoietic cancer in teachers. *Scand J Work Environ Health*;25:5-17.
22. Pearce N, McLean D (2005). Agricultural exposures and non-Hodgkin's lymphoma. *Scand J Work Environ Health*; 31 Suppl 1:18-25.
23. Brown TP, Rumsby PC, Capleton AC, Rushton L, Levy LS (2006). Pesticides and Parkinson's disease – is there a link? *Environ Health Perspect*; 114:156-164.
24. Li CY, Sung FC (2003). Association between occupational exposure to power frequency electromagnetic fields and amyotrophic lateral sclerosis: a review. *Am J Ind Med*; 43:212-220.
25. Knutsson A (2003). Health disorders of shift workers. *Occup Med*; 53:103-108.
26. Steenland K (1996). Epidemiology of occupation and coronary heart disease; research agenda. *Am J Ind Med*; 30:495-499.
27. Patel JV, Vyas A, Cruickshank JK et al.(2006). Impact of migration on coronary heart disease risk factors: comparison of Gujaratis in Britain and their contemporaries in villages of origin in India. *Atherosclerosis*; 185:297-306.
28. Palmer K, Coggon D (1997) Does occupational exposure to iron promote infection? *Occup Environ Med*; 54:529-534.
29. Palmer KT, Poole J, Ayres JG, Mann J, Burge PS, Coggon D (2003). Exposure to metal fume and infectious pneumonia. *Am J Epidemiol*; 157:227-233.
30. Steenland K, Sanderson W, Calvert GM (2001). Kidney disease and arthritis in a cohort of workers exposed to silica. *Epidemiol*; 12:405-412.
31. Health and Safety Commission (2007) Statistics of fatal injuries 2006/07. <http://www.hse.gov.uk/statistics/overall/fatI0607.pdf>

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