Asbestos-related disease statistics, Great Britain 2023

July 2023

Contents

Summary

Over 5,000

Asbestos-related disease deaths per year currently, including mesothelioma, lung cancer and asbestosis

2,268

Mesothelioma deaths in 2021, with a similar number of lung cancer deaths linked to past exposures to asbestos

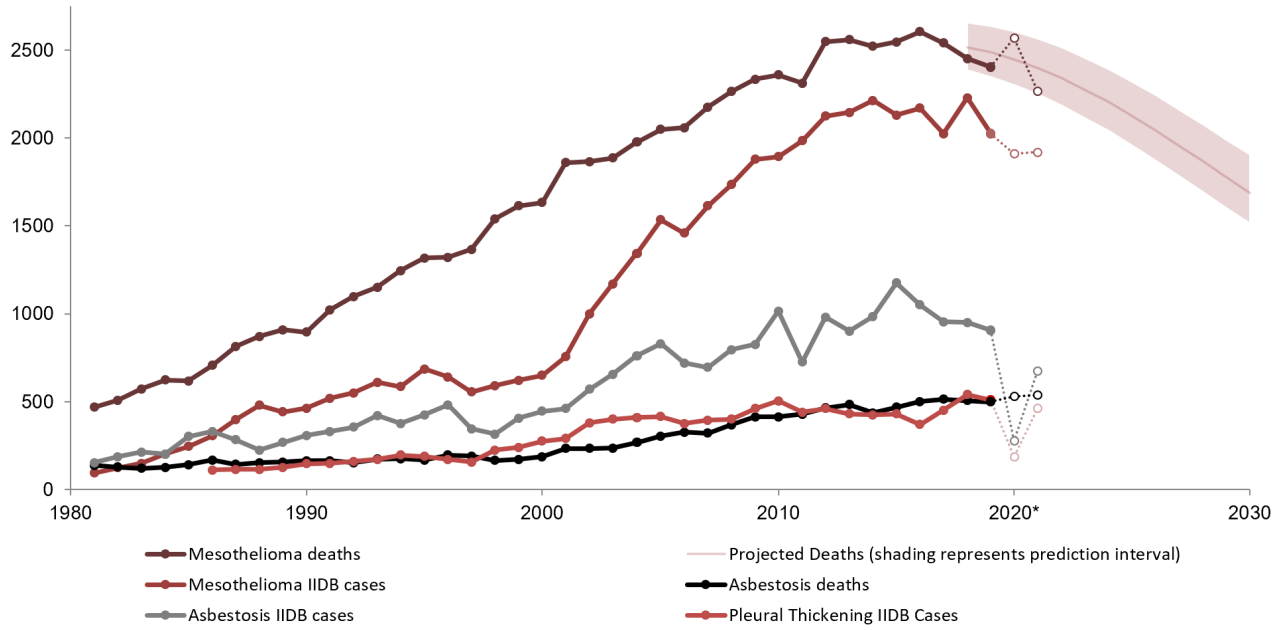
537

Deaths in 2021 mentioning asbestosis on the death certificate*

*Excluding deaths that also mention mesothelioma

- Inhalation of asbestos fibres can cause cancers such as mesothelioma and lung cancer, and other serious lung diseases such as asbestosis and pleural thickening
- All asbestos-related diseases typically take many years to develop so current statistics reflect the legacy of past working conditions.
- Widespread use of asbestos containing products in the past – particularly in the post-WWII building industry – led to a large increase in asbestos-related disease in Great Britain over the last few decades.
- The cancer, mesothelioma, has such a strong relationship with asbestos that annual deaths give a particularly clear view of the effect of past exposures.
- Annual mesothelioma deaths increased substantially over a number of decades, largely as a result of asbestos exposure prior to 1980, but have remained broadly level over the most recent decade.

Figure 1: Mesothelioma, asbestosis, and pleural thickening: time trends in annual deaths and Industrial Injuries Benefit Disablement (IIDB) cases



** Note. Figures for deaths occurring in 2020 and 2021 (shown as white circles) may have been affected by the coronavirus pandemic. Assessments of new IIDB cases were substantially reduced in 2020 and may also have been affected during 2021, though this less likely for mesothelioma due to its prioritisation for assessment.*

More detailed information on mesothelioma:

- Mesothelioma in Great Britain www.hse.gov.uk/statistics/causdis/mesothelioma/mesothelioma.pdf
- Interactive RShiny dashboard: https://lucydarnton.shinyapps.io/meso_rshiny/
- Mesothelioma Mortality in Great Britain by Geographical area, 1981–2021: www.hse.gov.uk/statistics/causdis/mesothelioma/mesoarea.pdf . Results are also available as interactive maps available at: https://arcg.is/1qO0G40.
- Mesothelioma Occupation Statistics – male and female deaths aged 16-74 in Great Britain 2011-2021 and 2001-2010: www.hse.gov.uk/statistics/causdis/mesothelioma/mesothelioma-mortality-by-occupation.pdf and www.hse.gov.uk/statistics/tables/mesooccupation.xlsx.
- Mesothelioma occupation statistics for males and females aged 16-74 in Great Britain, 1980-2000 www.hse.gov.uk/statistics/pdf/occ8000.pdf

Introduction

Inhalation of asbestos fibres can cause a number of serious diseases most of which affect the lungs or pleura (the external lining of the lung). These include a number of forms of cancer and chronic conditions such as asbestosis and pleural thickening. This document summarises the latest statistics on these diseases.

All of these diseases have a long latency, meaning it takes a long time – typically decades – for symptoms to occur following exposure to asbestos. However, for cancers such as mesothelioma and lung cancer, cases are often rapidly fatal following disease onset, while conditions such as asbestosis may progress over time to seriously affect normal daily activity and lead to complications which can be fatal.

Asbestos was used extensively in Great Britain in a wide range of products, but particularly in insulation and building materials, following World War II. Widespread asbestos-exposures during the 1950s, 1960s and 1970s led to a large increase in asbestos-related disease in Great Britain.

For some diseases – for example, mesothelioma and asbestosis – statistics can be derived from data sources that rely on counting of individual cases or deaths. For diseases that are regularly caused by other agents as well as asbestos – for example, lung cancer – statistics can be derived based on epidemiological evidence about the Attributable Fraction (AF) of cases or deaths due to asbestos exposure.

Asbestos-related cancers

Mesothelioma

Mesothelioma is a form of cancer that principally affects the pleura (the external lining of the lung) and the peritoneum (the lining of the lower digestive tract). It takes many years to develop following the inhalation of asbestos fibres. Cases are often diagnosed at an advanced stage as symptoms are typically non-specific and appear late in the development of the disease. It is almost always fatal, and often within twelve months of symptom onset.

Mesothelioma has such a strong relationship with asbestos that annual cases give a particularly clear view of the effect of past exposures, and as the disease is usually rapidly fatal following disease onset, the number of annual deaths closely approximates to the annual number of new cases (i.e. the annual disease incidence).

Annual deaths in Britain increased steeply over the last 50 years, a consequence of mainly occupational asbestos exposures that occurred because of the widespread industrial use of asbestos during 1950-1980.

The latest statistics are as follows:

- There were 2,268 mesothelioma deaths in Great Britain in 2021. This is a fall of 302 compared with the 2,570 deaths in 2020, and substantially lower than the average of 2520 deaths per year over period 2012 to 2019.
- The substantial reduction in deaths in 2021 remains consistent with earlier projections that annual deaths would fall gradually during the 2020s. Increased variability in the figures for 2020 and 2021 may have been caused by various factors associated with the coronavirus pandemic.
- There were 1,867 male deaths in 2021 compared with 2,103 in 2020 and an average of 2107 deaths per year over the period 2012-2019.
- There were 401 female deaths in 2021 compared with 467 in 2020 and an average of 416 deaths per year over the period 2012-2019. Predictions for females suggest that there will continue be 400-500 deaths per year during the 2020s.
- Figures for 2020 and 2021 may have been affected by the coronavirus pandemic. This could include direct effects (individuals with mesothelioma dying earlier than otherwise due to also developing COVID-19), indirect effects on health services and effects on systems for recording and certifying deaths.

- Around two thirds of annual deaths for both males and females now occur in those aged over 75 years. Annual deaths in this age group continue to increase while deaths below age 65 are decreasing.
- There were 1,920 new cases of mesothelioma assessed for Industrial Injuries Disablement Benefit (IIDB) in 2021 of which 325 were female. This compares with 1,910 new cases in 2020, of which 280 were female.
- Men who worked in the building industry when asbestos was used extensively in the past continue to be most at risk of mesothelioma.

A more detailed description of the latest mesothelioma statistics, including analyses by region and occupation is available at:

www.hse.gov.uk/statistics/causdis/mesothelioma/mesothelioma.pdf

Asbestos-related lung cancer

Asbestos is one of the most common causes of lung cancer after tobacco smoking. Lung cancer usually has no specific clinical signs associated with particular causes and so it is very difficult to be sure about the causes of individual cases. However, the overall proportion of annual deaths that are attributable to past asbestos exposures can be estimated from epidemiological information. Lung cancer is still typically fatal within a few years of diagnosis and so, as with the mesothelioma, the number of annual deaths is broadly similar to the annual incidence of new cases.

Epidemiological studies of specific groups of workers that were heavily exposed to asbestos in the past have typically estimated a greater number of lung cancers attributed to asbestos than there were mesotheliomas, though the ratio depends on the type of asbestos and the typical amount of exposure in these settings [note 1]. Other studies that are more representative of the British population as a whole provide the best basis for estimating the overall number of asbestos-related lung cancers nationally. Such evidence suggests that there are around as many lung cancer cases attributed to past asbestos exposure each year as there are mesotheliomas, though this estimate is uncertain [note 2 and 3].

A ratio of one asbestos-related lung cancer for every mesothelioma implies there are currently around 2,500 asbestos-related lung cancer deaths each year.

It is expected that there will be fewer asbestos-related lung cancers per mesothelioma in the future as a consequence of reductions in both asbestos exposure and smoking – which act together to increase the risk of lung cancer – in past decades.

Data sources that rely on the counting of individual cases attributed to asbestos exposures, such as the Industrial Injuries Disablement Benefit (IIDB) and the Health and Occupation Reporting (THOR) schemes, tend to substantially underestimate the true scale of asbestos-related lung cancer.

In the ten years prior to the coronavirus pandemic (2010-2019) there were, on average, around 260 new cases of asbestos-related lung cancer each year within the IIDB scheme. There were 185 cases in 2020 and 180 in 2021. (see table IDB01 www.hse.gov.uk/statistics/tables/iidb01.xlsx). There were an estimated 74 cases of lung cancer identified by chest physicians in 2019 within the THOR scheme, close to the average of 73 per year over the previous ten years. Most of these cases are associated with asbestos. There were four reported cases in 2021 and one in 2020, the low numbers in these latest two years being due to the effect of the coronavirus pandemic on reporting by chest physicians in the THOR scheme (See table THORR01 www.hse.gov.uk/statistics/tables/thorr01.xlsx). Typically, females account for 2% of IIDB cases and less than 1% of THOR cases.

Estimates of the burden of lung cancer attributable to occupational exposures other than asbestos are available based on the Burden of Occupational Cancer research (www.hse.gov.uk/cancer/research.htm) [note 4].

Other asbestos-related cancers

In their most recent review, the International Agency for Research on Cancer (IARC) concluded that in addition to mesothelioma and lung cancer there is sufficient evidence that asbestos can cause cancer of the larynx, ovary, pharynx and stomach [note 5].

Two of these cancers (larynx and stomach) were already known to be caused by asbestos when the Burden of Occupational Cancer research (www.hse.gov.uk/cancer/research.htm) [note 4] was carried out and so estimates of the current annual number of new cases and deaths are available.

Based on mortality data for 2017-2021 and cancer incidence data for 2015-2019, the current estimated annual number of cases and deaths attributed to past asbestos exposure were:

- for cancer of the larynx: 9 cases and 3 deaths;
- for cancer of the stomach: 39 cases and 25 deaths.

Non-malignant asbestos-related diseases

Asbestosis

Asbestosis is a form of pneumoconiosis caused by the inhalation of asbestos fibres, which is characterised by scarring and inflammation of the lung tissue. It is a chronic and irreversible condition in which symptoms typically start to develop several decades following exposure to asbestos. These often progress to seriously affect normal daily activity and can lead to various complications which can be fatal.

It is generally recognised that heavy asbestos exposures are required in order to produce clinically significant asbestosis within the lifetime of an individual. Current trends therefore still largely reflect the results of heavy exposures in the past.

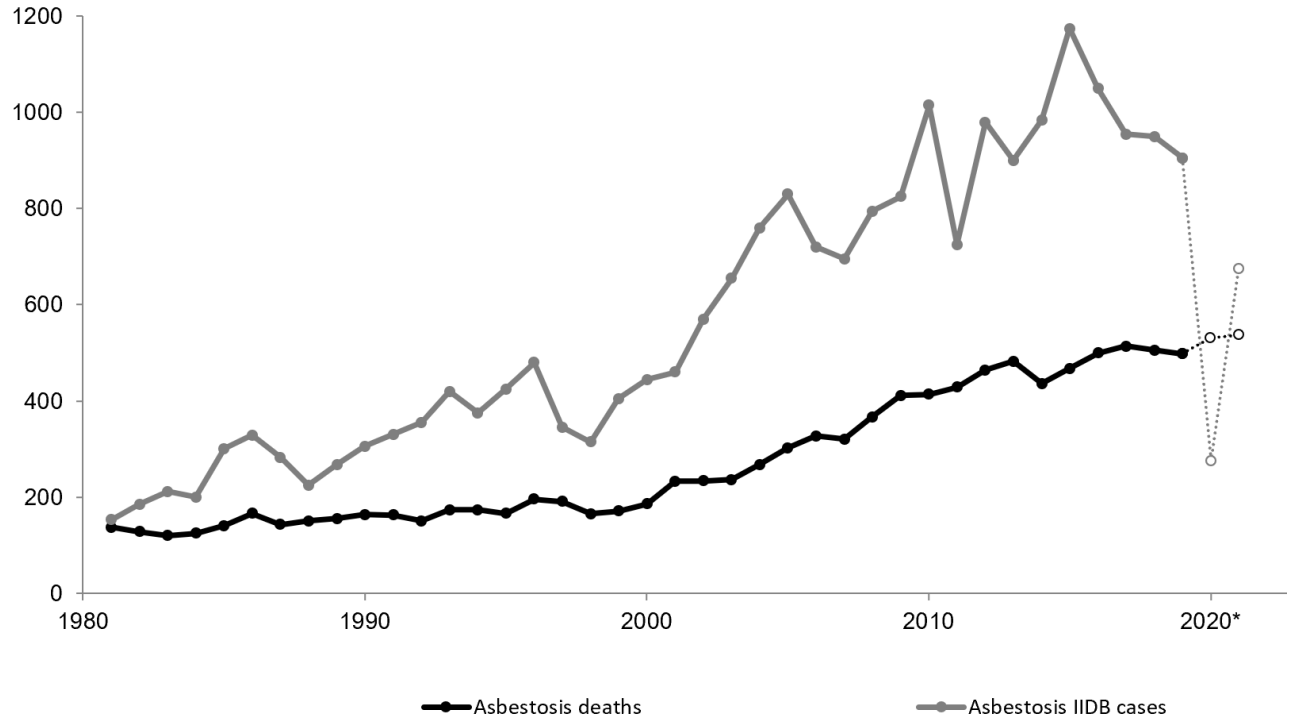
The latest statistics for deaths where asbestosis contributed as a cause of death based on the Asbestosis Register show:

- Deaths mentioning asbestosis (excluding those that also mention mesothelioma) have increased substantially over a number of decades: there were 537 such deaths in 2021 compared with around 100 per year in the late 1970s. Typically, in recent years, around 2-3% of these deaths were among women.
- Deaths also mentioning mesothelioma are excluded from this figure, since in such cases the term ‘asbestosis’ may have been used incorrectly to indicate the role of asbestos in causing the separate disease mesothelioma. There were 27 such deaths in 2021.
- In around a third of the 537 deaths in 2021, asbestosis was mentioned on the death certificate as the underlying cause of death.
- The figures for 2020 and 2021 are likely to have been affected by the coronavirus pandemic. Death certificates mentioned COVID-19 as well as asbestosis in 116 of the 537 deaths in 2021, and in 104 of these COVID-19 was recorded as the underlying cause of death. Numbers were similar in 2020 with 112 of the 531 deaths mentioning both COVID-19 and asbestosis, of which 103 were recorded as COVID-19 as the underlying cause of death. Some of these deaths may have occurred earlier than otherwise had the pandemic not taken place.
- In 170 of the 567 total deaths (i.e. including those that mentioned both asbestosis and mesothelioma) in 2021 asbestosis was recorded as the underlying cause of death compared with 191 of the 564 such deaths in 2020. The reduction could be at least partly due to some deaths where both asbestosis and COVID-19 played a role being recorded as COVID-19 in the underlying cause rather than asbestosis.

- Interpretation of these figures is further complicated by the fact that cases of asbestosis may sometimes not be recorded as such because they may be mistaken for other types of lung fibrosis – or recorded as “idiopathic” cases (i.e. lung fibrosis without a known cause) [note 6] – or may go undiagnosed.

Table IIDB06 www.hse.gov.uk/statistics/tables/iidb06.xlsx shows the number of new cases of asbestosis (and other forms of pneumoconiosis) assessed under the Industrial Injuries and Disablement Benefit (IIDB) scheme. The number of cases of asbestosis has increased substantially over the long term from 132 in 1978 to 905 in 2019 (see Figure 2) of which 1-2% were among women. There were 675 cases in 2021 and 275 cases in 2020 but these figures are likely to have been affected by a substantial reduction in new cases assessed during the coronavirus pandemic.

Figure 2: Annual deaths where death certificates mentioned asbestosis but not mesothelioma 1978-2020, and IIDB cases 1978-2021



** Note. Figures for deaths occurring in 2020 and 2021 (shown as white circles) may have been affected by the coronavirus pandemic. Assessments of new IIDB cases were substantially reduced in 2020 and may also have been affected during 2021, though this less likely for mesothelioma due to its prioritisation for assessment.*

Table THORR01 (www.hse.gov.uk/statistics/tables/thorr01.xlsx) gives a breakdown of the pneumoconiosis cases seen by chest physicians in the THOR scheme. There were 159 cases of asbestosis out of the estimated 236 pneumoconiosis cases reported to respiratory physicians in 2019. Reporting of new cases during 2020 and 2021 was

disrupted by the coronavirus pandemic: in 2021 there were an estimated 55 (83 in 2020) pneumoconiosis cases, of which 31 were asbestosis. This compares with 83 estimated cases in 2020, of which 51 were asbestosis. Typically, less than 1% of cases were among females.

The statistics based on reporting by chest physicians in the THOR scheme prior to the coronavirus pandemic also support a continuing increase in annual asbestosis cases. Analyses of trends in THOR data [note 7] suggest that the incidence of all pneumoconiosis – the majority of which is known to be asbestosis within that scheme – has been increasing with an average change of + 3.6 % per year (95% CIs: +2.1, +5.0) over the time period 1999-2019. For the more recent period 2010-2019, the equivalent estimate was +5.7% per year (95% CIs: +2.2, +9.3), with the increase largely due to asbestos rather than silica, coal etc.

Asbestosis deaths by age group and time period

Table ASIS02 www.hse.gov.uk/statistics/tables/asis02.xlsx shows the total number of death certificates mentioning the term asbestosis without mention of mesothelioma among males, and equivalent death rates, by age group for the three-year time periods during 1978-2021.

Age-specific death rates for males are also shown in Figure 3 below.

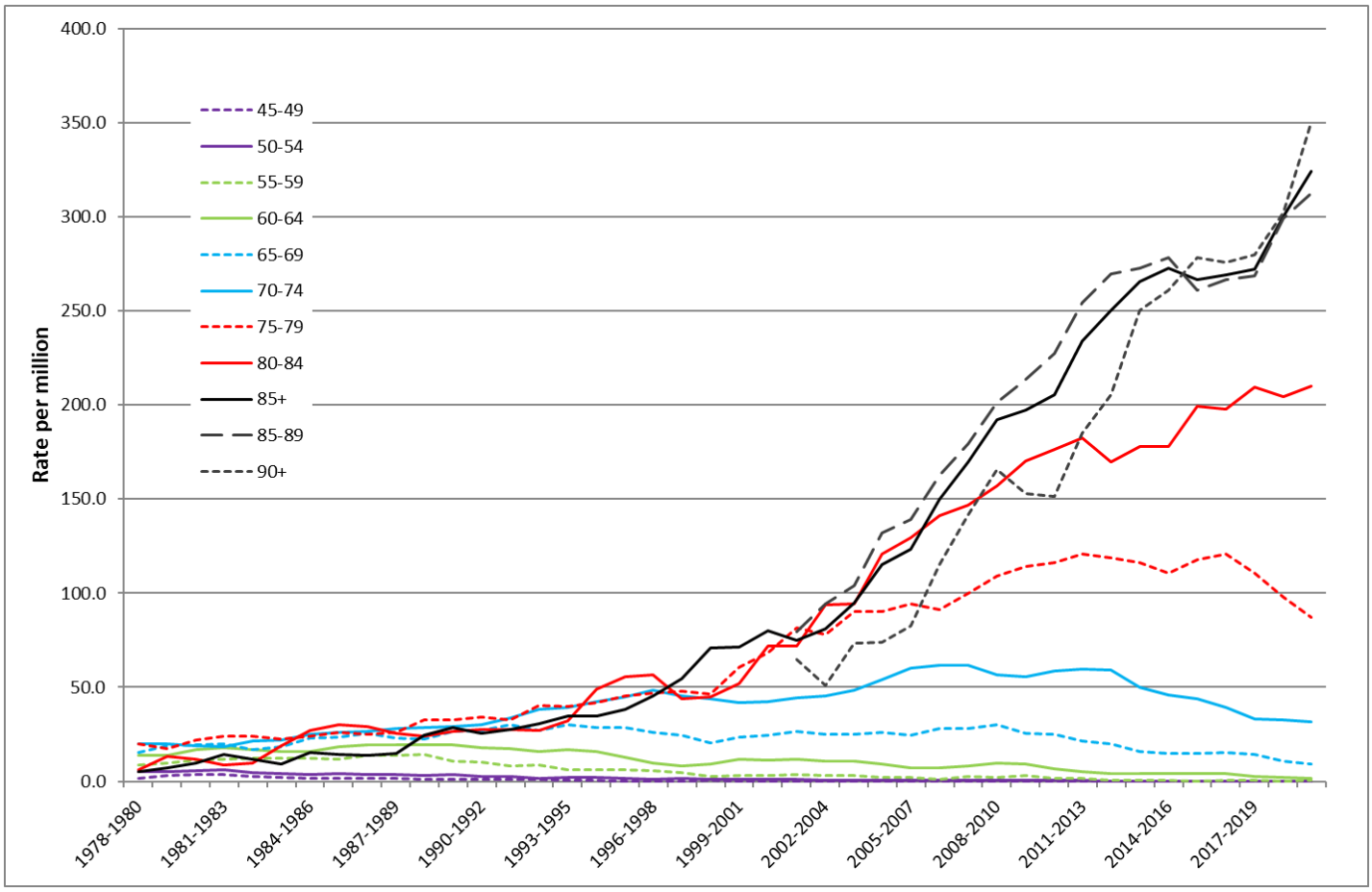
There are large differences in the magnitude of the rates between the different age groups:

- Death rates at ages below 65 years have been falling since the 1980s;
- This contrasts with continuing strongly increasing rates for deaths at ages 75 years and above.

This is consistent with those that were born more recently tending to have lower asbestos exposures than those born earlier and who were of working age during the period when asbestos was most widely used.

Due to the small number of female deaths, age-specific death rates for women have not been shown, but also indicate an increase in rates in the 85-89 and 90+ age bands over the last 10 years.

Figure 3: Average annual male death rates based on death certificates mentioning asbestosis but not mentioning mesothelioma by age and time period, 1978-2021(p)



Note: rates for the age band 85+ years can be split into 85-89 and 90+ from year 2001 only (broken black lines).

Asbestosis deaths by region

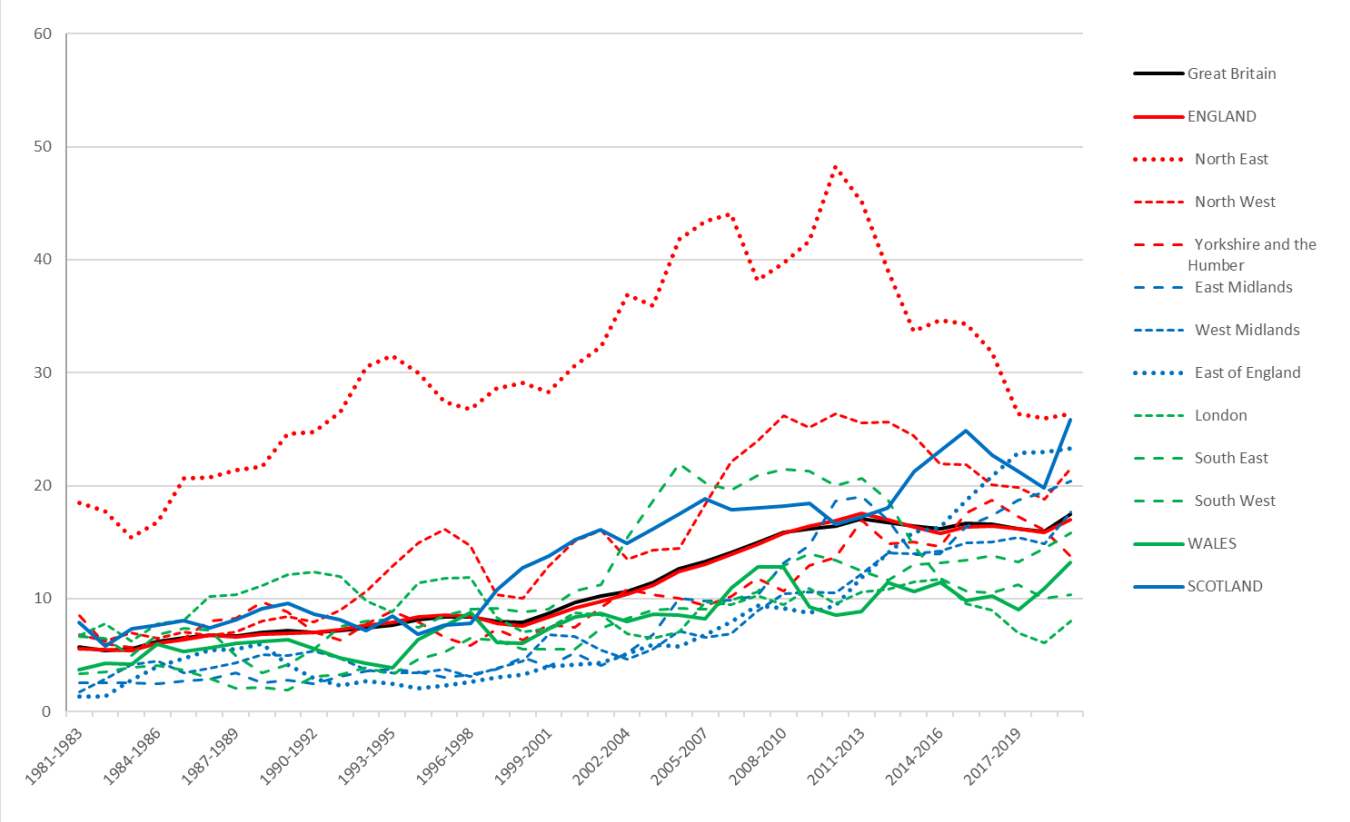
Age-standardised death rates for males by 3-year time period and region (again restricted to deaths mentioning asbestosis but not mesothelioma) are available in Table ASIS03 www.hse.gov.uk/statistics/tables/asis03.xlsx.

Age-standardisation allows comparison of rates taking account of changes in the age-structure of the underlying population over time and between regions. The period 2019-2021 was taken as the base for standardisation over time and Great Britain for standardisation over region. A small number of deaths with overseas addresses were excluded.

For Great Britain as a whole, male asbestosis death rates increased from 5.6 per million in 1981-83 (the earliest period available for regional data) to 16.8 in 2019-21. Male regional

rates have similarly increased over time, although to a lesser extent in Wales and London. The highest rates are now in the North East (where they have declined from a peak of 48.2 in 2010-12 to 26.3 per million in 2019-21), the East of England (23.3) and in the North West (21.6).

Figure 4 – Average annual regional male death rates per million based on death certificates mentioning asbestosis but not mentioning mesothelioma by time period, 1978-2021(p)



The female asbestosis death rates for GB have remained broadly constant since the 1980s with an average of 0.3 per million per year. The only region with substantially higher rates than this was the North East, but its rate fell to 0.7 per million in 2019-21, the same as for Scotland and the East of England.

More detailed analyses of asbestosis mortality by Unitary Authority (UA) and Local Authority (LA) area for the period 1981 to 2021 are available in Annex 1, with associated data tables available at www.hse.gov.uk/statistics/tables/ASISAREA.xlsx and interactive maps at https://arcg.is/1mS5aj.

Non-malignant pleural disease

Non-malignant pleural disease is a non-cancerous condition affecting the outer lining of the lung (the pleura). It includes two forms of disease: diffuse pleural thickening and the less serious pleural plaques. A substantial number of cases continue to occur each year in Great Britain, mainly due to workplace asbestos exposures many years ago.

- In 2021 there were 460 cases new cases of pleural thickening assessed for Industrial Injuries Disablement Benefit compared with 185 in 2020. These figures – particularly that for 2020 – are likely to have been affected by a reduction in new cases assessed during the coronavirus pandemic. (See table IIDB01 www.hse.gov.uk/statistics/tables/iidb01.xlsx.)
- The number of new cases in 2021 is in line with the annual number over the 10 years prior to 2020 which has been fairly constant, with an average of around 460 new cases per year of which around 1% are female.
- An estimated 366 new cases of non-malignant pleural disease mainly caused by asbestos were reported by chest physicians in 2019. Reporting of new cases during 2020 and 2021 was disrupted by the coronavirus pandemic: there were an estimated 104 cases in 2021 and 148 in 2020. Typically, around 2-3% of cases are female. A substantial proportion of these were cases of pleural plaques. (See table THORR01 www.hse.gov.uk/statistics/tables/thorr01.xlsx.)
- Pleural plaques are usually symptomless and are often identified in the THOR scheme when individuals have chest x-rays for other conditions. For these reasons, there are likely to be substantially more individuals in the population with pleural plaques than those identified by chest physicians.

Annex 1: Asbestosis deaths by geographical area 1981-2021

Introduction

This analysis of asbestosis mortality by Unitary Authority (UA) and Local Authority (LA) area includes deaths occurring during the period 1981 to 2021, the longest period for which data are available according to the current UA and LA structure. It also provides detailed analysis of temporal trends within selected geographical areas using Generalised Additive Models.

The analyses presented in the maps and charts in this annex are based on the 11,250 male and 379 female deaths occurring during 1981 to 2021 due to asbestosis, defined as any death with asbestosis recorded on the death certificate (either as the underlying cause or otherwise mentioned) but excluding deaths that also mentioned mesothelioma. During this period, male asbestosis deaths increased from 130 in 1981 to 528 in 2021; female deaths fluctuated between 5 and 17 a year.

Annual deaths with asbestosis as the underlying cause and all deaths mentioning asbestosis (including those that also mention mesothelioma) are shown in Figure A3.1 in Annex 3 for comparison with the deaths included is this analysis.

Results are available as interactive maps at: https://arcg.is/1mS5aj

Full results are also available in Excel tables at www.hse.gov.uk/statistics/tables/ASISAREA.xlsx , including additional analyses based on all death certificates mentioning asbestosis (including those that also mention mesothelioma) and analyses restricted to where the underlying cause of death was recorded as asbestosis.

The analysis is based on the last area of residence of the deceased, as recorded on death certificates, and uses Standardised Mortality Ratios (SMRs) which compare the mortality rate in a particular area with the mortality rate for GB, taking account of age differences. SMRs are expressed as a percentage: values higher or lower than 100 indicate mesothelioma rates that are higher or lower, respectively, than for GB as a whole.

The analyses of temporal trends for geographical areas within Great Britain should be interpreted in the context of increasing annual asbestosis deaths in Great Britain as a whole. Overall deaths have increased substantially since the 1970s. Since Standardised Mortality Ratios (SMRs) compare the mortality rate in a particular region with that for GB as a whole, trends in SMRs for a particular area indicate whether rates for that area have increased relatively more or less rapidly than for GB as a whole. No change in the SMR for an area over time indicates that the mortality rates have increased in line with the trend for GB as a whole.

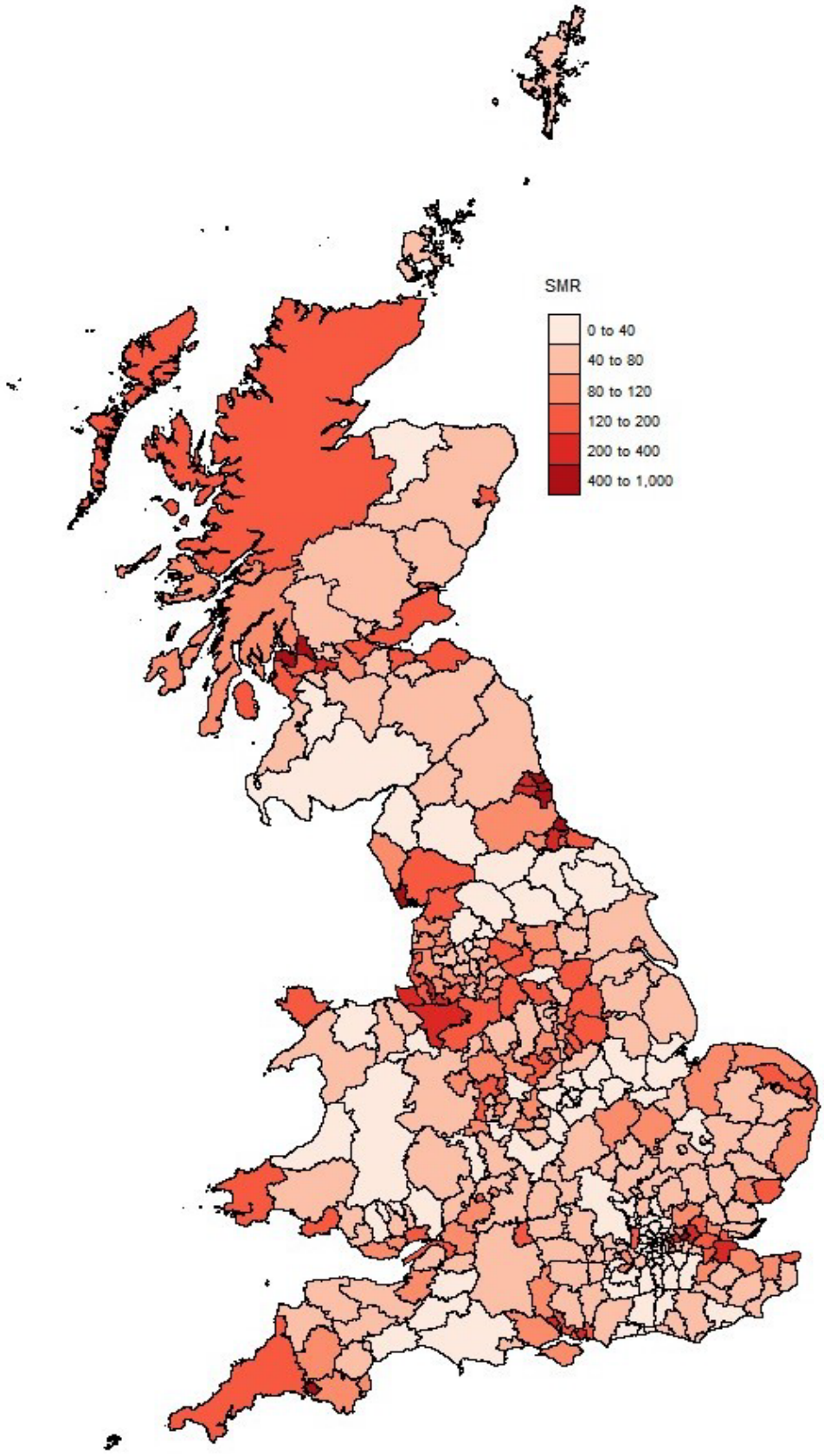


Figure A1.1 – Asbestosis SMRs for males by geographical area 1981-2021

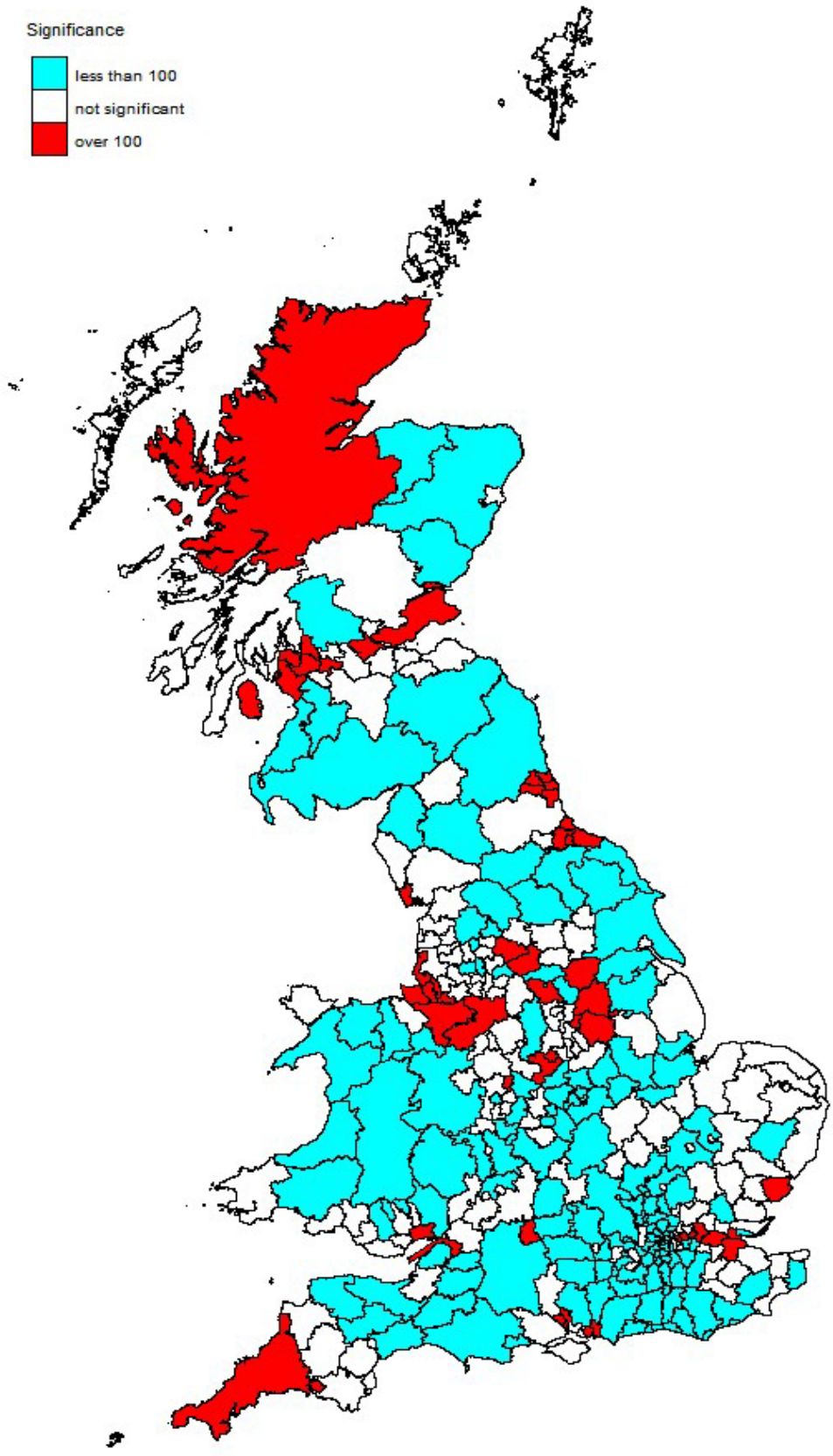


Figure A1.2 – Statistical significance of asbestosis SMRs for males by geographical area 1981-2021

Results

Figure A1.1 is a map showing SMRs by Unitary/Local Authority area for males for the overall period 1981-2021. Figure A1.2 highlights those areas for which the mortality rate was statistically significantly higher or lower than for GB as a whole.

Temporal trends in asbestosis mortality

Temporal variation in asbestosis SMRs for regions within Great Britain and selected Unitary/Local Authority areas are shown graphically in this section.

Charts with trend lines shown with solid bold **black** lines indicate statistically significant temporal changes, those with **green** lines indicate trends of borderline significance, while those with **blue** lines trends were not significant. The dashed lines represent the 95% confidence intervals.

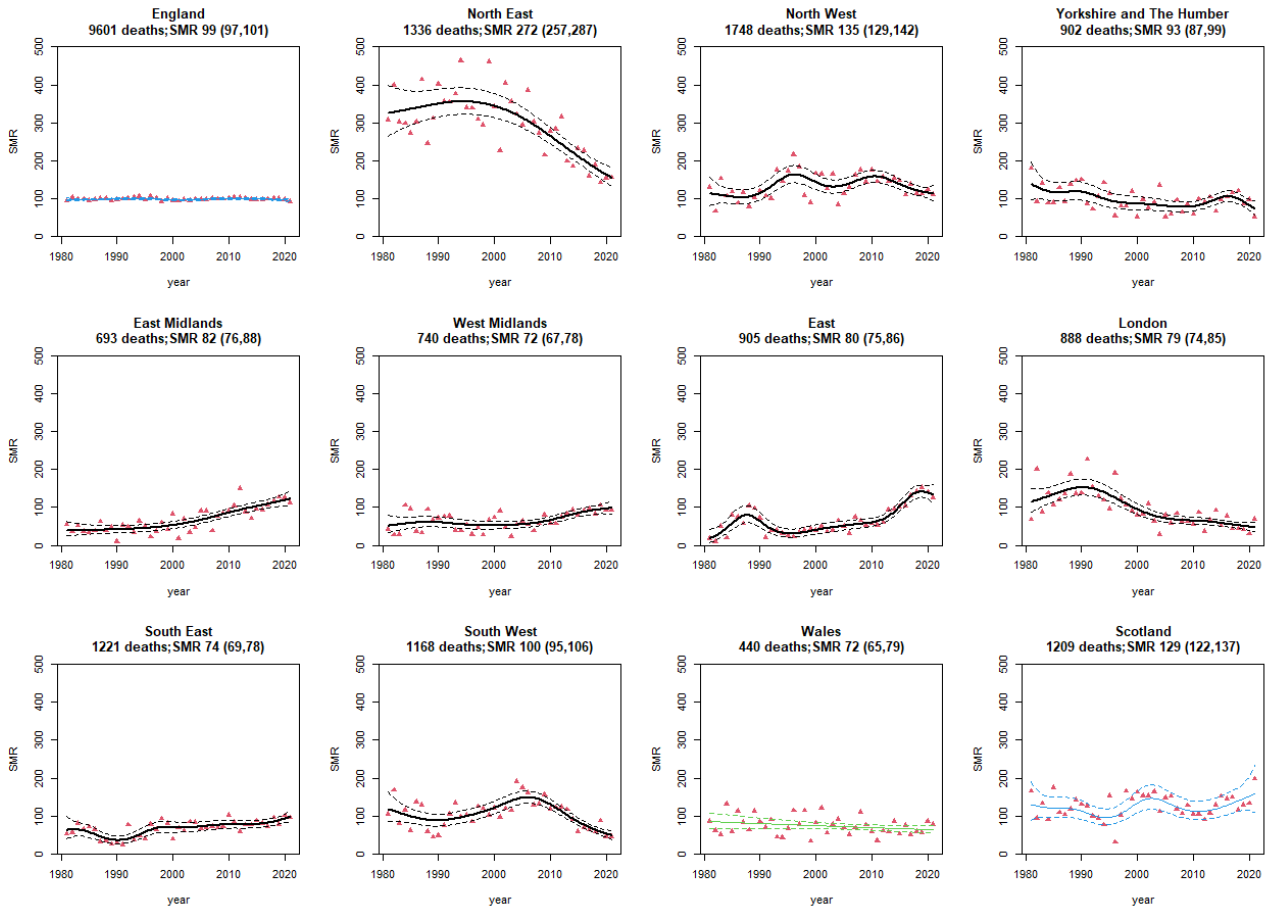


Figure A1.3 – Annual asbestosis SMRs for males by region, 1981-2021

Male asbestosis deaths by area 1981-2021

Figure A1.3 shows the regional variation for male SMRs calculated annually along with 95% confidence intervals.

There were statistically significant temporal changes in the SMR in all regions except Wales and England as a whole. The highest male SMR for asbestosis was seen in the North East (SMR 271.7, 95% Confidence Interval 257.4 to 286.7, deaths 1336), although there was a significant declining trend over time. SMRs elsewhere were much lower. For example, in the South West, whilst the SMR for 1981-2021 as a whole was significantly higher than 100, the trend analysis suggests it has reduced to being significantly lower than 100 in recent years.

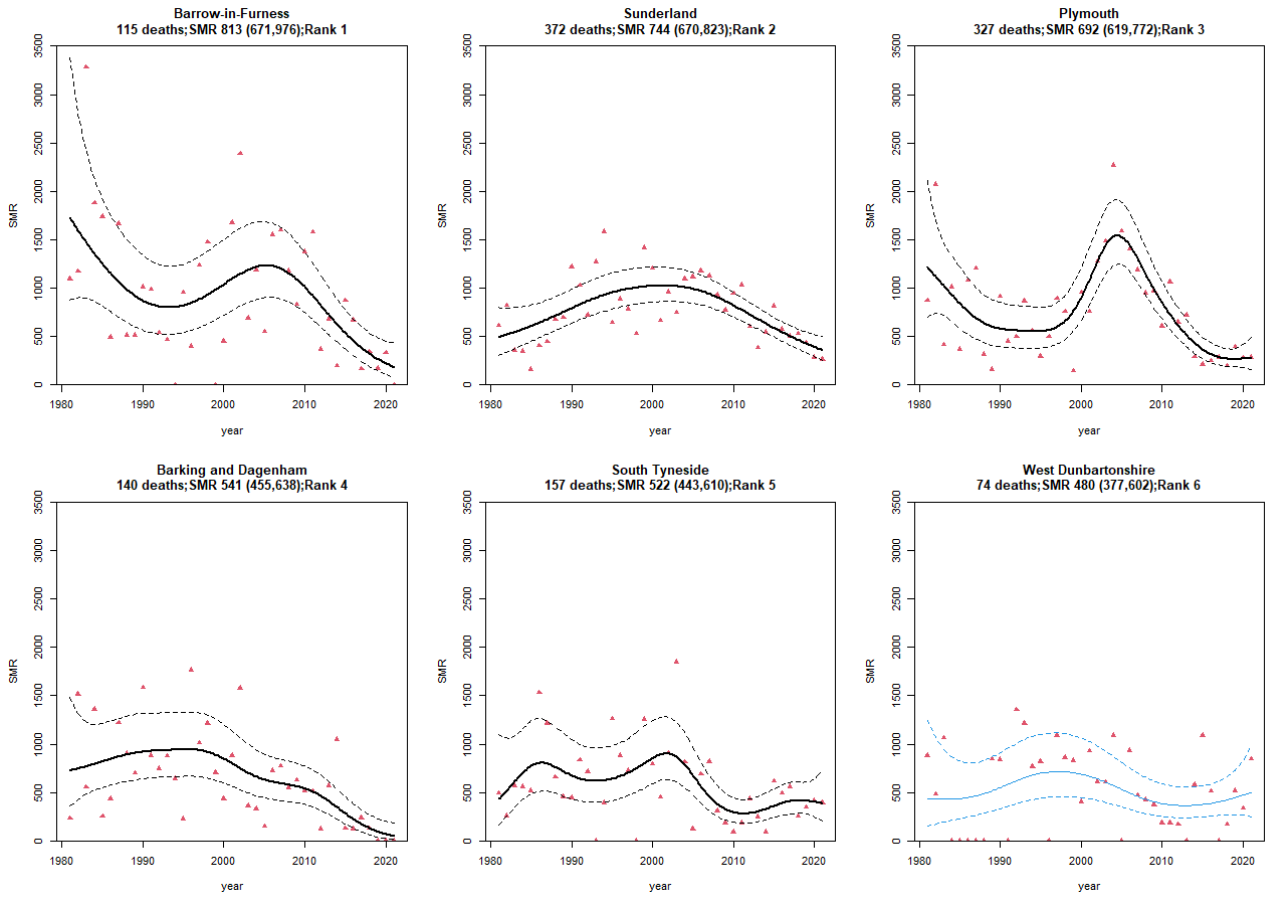


Figure A1.4 – Annual asbestosis SMRs for males for the top six UA/LA areas, 1981-2021

Unitary/Local authority areas with the highest male asbestosis SMRs for the period 1981-2021 were:

- 1 Barrow-in-Furness (SMR 813.4, 95% CI 671.4 to 976.4, deaths 115)
- 2 Sunderland (SMR 743.6, 95% CI 670 to 823.2, deaths 372)
- 3 Plymouth (SMR 692.4, 95% CI 619.4 to 771.7, deaths 327)
- 4 Barking and Dagenham (SMR 541.0, 95% CI 455.1 to 638.4, deaths 140)
- 5 South Tyneside (SMR 521.5, 95% CI 443.1 to 609.8, deaths 157)
- 6 West Dunbartonshire (SMR 479.9, 95% CI 376.9 to 602.5, deaths 74)
- 7 Hartlepool (SMR 451.9, 95% CI 355.4 to 566.5, deaths 75)
- 8 Inverclyde (SMR 437.9, 95% CI 339.4 to 556.2, deaths 67)
- 9 North Tyneside (SMR 422.0, 95% CI 359.8 to 491.7, deaths 164)
- 10 Newham (SMR 385.6, 95% CI 316.2 to 465.5, deaths 108)

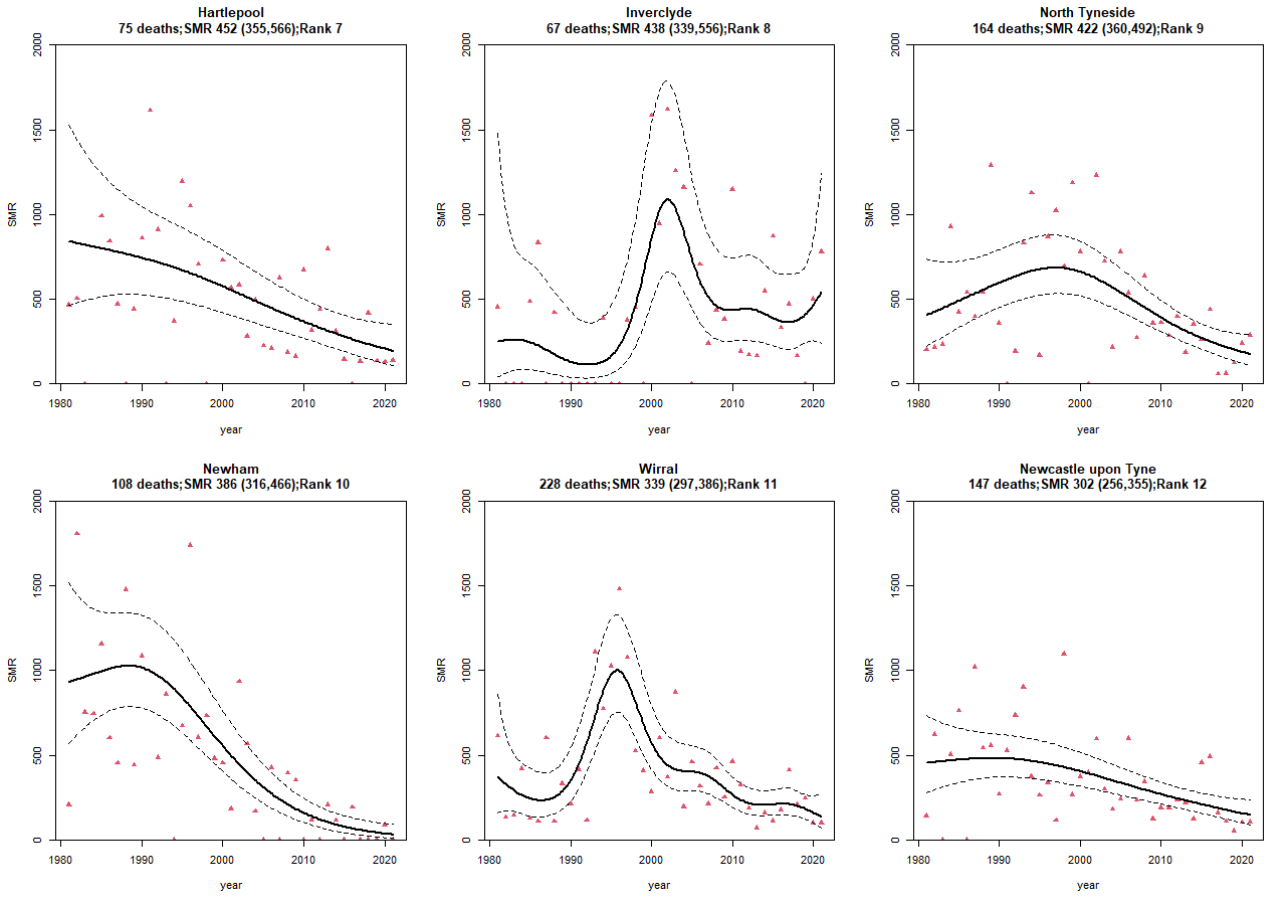


Figure A1.5 – Annual asbestosis SMRs for males for UA/LAs ranked 7-12, 1981-2021

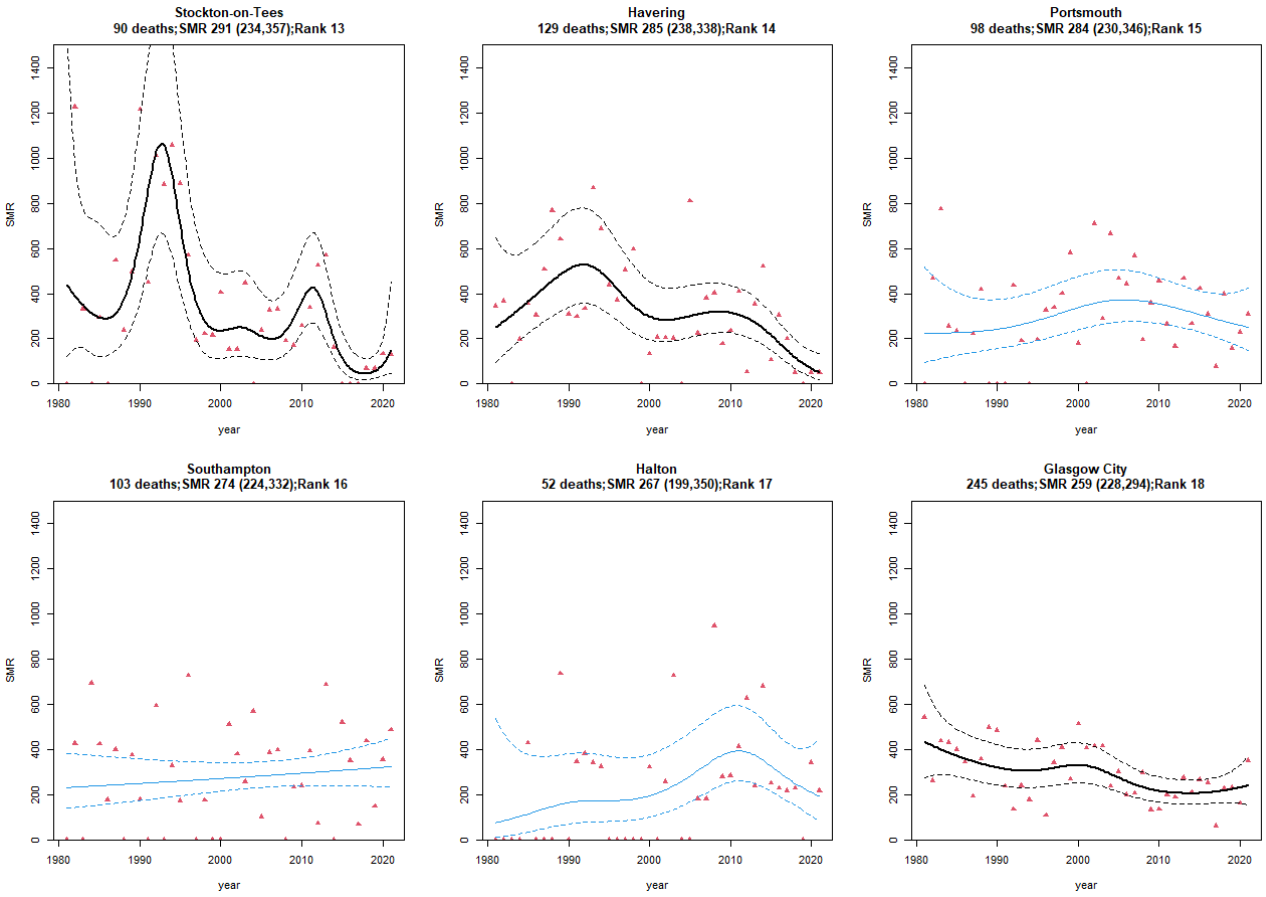


Figure A1.6 – Annual asbestosis SMRs for males for UA/LAs ranked 13-18, 1981-2021

Female asbestosis deaths by area 1981-2021

There were far fewer asbestosis deaths among females than males. SMRs for many UA/LA areas were therefore associated with considerable uncertainty due to there being small numbers of actual deaths observed, and no analyses of temporal trends for females are presented. Nevertheless, the results for the whole period 1981-2020 show that certain areas known to be associated with industries with heavy historic asbestos exposures have particularly high SMRs.

The North East region accounted for 128 deaths of the 379 deaths for GB as a whole during 1981-2021 (SMR 756.5, 95% CI 631.1to 899.6), and the top five Unitary/Local Authority areas were:

- 1 Sunderland (SMR 4576.5, 95% CI 3634.7 to 5688.4, deaths 81)
- 2 Barking and Dagenham (SMR 1788.6, 95% CI 1041.6 to 2863.8, deaths 17)
- 3 Newham (SMR 1366.9, 95% CI 727.6 to 2337.5, deaths 13)
- 4 South Ribble (SMR 1063.8, 95% CI 427.0 to 2191.4, deaths 7)
- 5 Darlington (SMR 854.5, 95% CI 313.3 to 1860.0, deaths 6)

Annex 2 – Methodology for the mortality analyses by geographical area

Data for death certificates mentioning asbestosis occurring during the period 1981-2020 were obtained from the Health and Safety Executive Asbestosis Register. SMRs were derived using mid-year population estimates provided by the Office for National Statistics.

The method of age standardisation used in the production of SMRs is commonly referred to as the indirect method. Age-specific death rates in a standard population (in this case Great Britain by gender) are applied to the age structure of the population for each geographical area in order to calculate expected numbers of deaths. The ratio of the observed number of deaths to the expected number of deaths in the area is calculated and multiplied by 100 to give the SMR. The SMR of the standard population is 100. An SMR greater or less than 100 indicates a respectively higher or lower than expected mortality rate in a specific area. If the lower bound of the 95% Confidence Interval for the SMR is greater than 100 this indicates that the observed number of deaths was statistically significantly higher than expected. A worked example of the SMR calculation is provided below.

The statistical models involved fitting a smoothed term for the year in a Generalized Additive Model (GAM) to identify annual trends. In a most cases a Poisson error term was assumed; for a small number of cases a Negative Binomial or Normal (Gaussian) error term was assumed.

SMR calculation – worked example

Table A2.1 illustrates the calculation of an SMR for men in geographical area ‘A’. The total population of Great Britain is used as the standard population (column 1). The asbestosis death rate in the population for each age group (column 3) is the total number of male asbestosis deaths (column 2) divided by the total number of men in Great Britain (column 1) to give age-specific death rates in the standard population. These rates are applied to the total population in area A, given in column 4, to give the expected numbers of deaths in this area, in column 6. The total observed number of deaths summed over the age groups (532, column 5) divided by the expected number of deaths (210.57, column 6), multiplied by 100, gives an SMR of 252.7.

Age group	Total persons in Great Britain			Persons in geographical area 'A'		
	Population	Asbestosis deaths	Asbestosis death rate	Population	Observed asbestosis deaths	Expected asbestosis deaths
	(1)	(2)	(3) = (2) / (1)	(4)	(5)	(6) = (3) x (4)
0 - 4	285,545	0	0	6,926	0	0
5 - 9	296,837	0	0	8,514	0	0
10 - 14	323,242	0	0	9,286	0	0
15 - 19	350,617	1	<0.00001	8,729	0	0.02
20 - 24	349,316	1	<0.00001	7,833	0	0.02
25 - 29	329,490	5	0.00002	7,907	0	0.12
30 - 34	311,884	16	0.00005	7,770	3	0.40
35 - 39	292,209	76	0.00026	6,443	6	1.68
40 - 44	274,546	199	0.00072	6,222	14	4.51
45 - 49	249,834	402	0.00161	6,243	40	10.05
50 - 54	243,985	699	0.00286	6,391	66	18.31
55 - 59	240,015	1,141	0.00475	6,269	75	29.80
60 - 64	221,551	1,412	0.00637	5,367	77	34.21
65 - 69	195,541	1,531	0.00783	4,997	89	39.12
70 - 74	152,322	1,319	0.00866	3,729	78	32.29
75 - 79	102,328	1,308	0.01278	2,176	45	27.81
80 - 84	51,761	472	0.00912	1,007	25	9.18
85+	25,034	145	0.00579	525	14	3.04
Total, all ages	**4,296,057**	**8,727**		**106,334**	**532**	**210.57**

SMR = 100 x 532 / 210.57 = 252.7

Table A2.1: Example of SMR calculation

Annex 3 – non-mesothelioma asbestosis deaths by occupation in Great Britain

Background

These statistics are based on the last occupation of the deceased, as recorded on death certificates for deaths mentioning asbestosis as a cause of death. The Proportional Mortality Ratio (PMR) presented for each occupation compares the frequency that the occupation is recorded for asbestosis deaths with the frequency that it is recorded for deaths from all causes of death as a whole. PMRs thus provide a way of highlighting occupations that may be associated with higher-than-average mortality from asbestosis.

Full results of the PMR calculations by occupation in Great Britain are available in Excel tables at:

www.hse.gov.uk/statistics/tables/asisoccupation.xlsx.

Tables show the numbers of asbestosis deaths and PMRs for males by Standard Occupational Classification (SOC) major (1-digit code), sub-major (2-digit code), minor (3-digit code) and unit (4-digit code) groups.

Previous statistics included the 10-year time-period 2011-2020 as well as the previous period of 2001-2010. Occupations in the latest year's data (2021) are still coded to SOC2010 and are therefore incorporated into an analysis of the 11-year period 2011-2021 rather than presenting PMRs for a single year (2021) as this would lead to many results being based on small numbers. The previous statistics for 2011-2020 and 2001-2010 are also presented for completeness.

Two versions of each analysis are presented: the first includes deaths mentioning asbestosis but excluding those also mentioning mesothelioma (our preferred measure of asbestosis mortality – see main section of report), in Tabs 1, 1A and 3; the second includes all deaths mentioning asbestosis (Tabs 2, 2A and 4). All figures quoted in this Annex and in the analyses of time trends are based on the former preferred measure.

Due to the small number of asbestosis deaths among women it was not feasible to carry out PMR analyses for females.

SOC codes form a nested hierarchy: the first digit of any full 4-digit unit group code gives its major group, the first two digits gives it sub-major group and the first three digits gives its minor group.

Tables include ranks from highest to lowest PMR within each 1- to 4-digit level separately (groups with 10 or fewer observed or expected asbestosis deaths are not included in the rankings due to the uncertainty associated with smaller numbers).

Methods and limitations

The observed number of deaths in a particular occupation does not represent the actual number of deaths that are attributable to asbestos exposures in that occupation.

PMRs summarise mortality among occupational groups relative to the average level across all occupations for Great Britain as a whole and do not represent absolute measures of risk.

PMRs are expressed as a percentage: values higher or lower than 100 indicate asbestosis rates that are higher or lower, respectively, than the average for all occupations combined. The corresponding confidence interval should be used to assess whether such an effect could merely be due to random variation.

Occupations with the highest PMRs and where the lower limit of the associated Confidence Interval (CI) are above 100 constitute those that can most reliably be said to have an excess of asbestosis deaths compared to the average for all occupations, and are, therefore, those most likely to be reflecting an effect due to past occupational asbestos exposure.

Last occupation of the deceased

Occupation is recorded on death certificates for deaths at ages 16-74 as a matter of course. These analyses are limited by the fact that death certificates record only the last occupation of the deceased. For example, a case of asbestosis caused by work in the construction industry will only be assigned to that occupation in this analysis if the individual is still in that kind of work when they retired or died.

Occupations with the highest PMRs will tend to be those which are genuine sources of risk, but PMRs may understate the true relative risk level. PMRs of other occupations will overstate the level of any risk associated with these jobs.

A further consideration for asbestosis mortality statistics by occupation relates to the fact that the diagnosis of asbestosis itself requires knowledge of a person’s job history as an indication of the likelihood of asbestos exposure in combination with the clinical features of the disease. Information about job histories may thus affect both whether cases are correctly recognised as asbestosis at initial diagnosis and the job assigned on death certificates.

Overall PMRs for 2011-2021 and temporal trends for 2001-2021

This section presents time trends in PMRs for selected occupations within different levels of the SOC hierarchy where occupational categories based on SOC2000 and SOC2010 were equivalent.

Trends for a particular occupation indicate how the proportion of deaths with a particular occupation recorded has changed over time, rather than the absolute numbers.

The charts show trend lines with solid bold **black** lines to indicate a statistically significant annual trend. Those with **green** lines indicate trends of borderline significance, and for those with **blue** lines trends were not significant. The dashed lines represent the 95% confidence intervals.

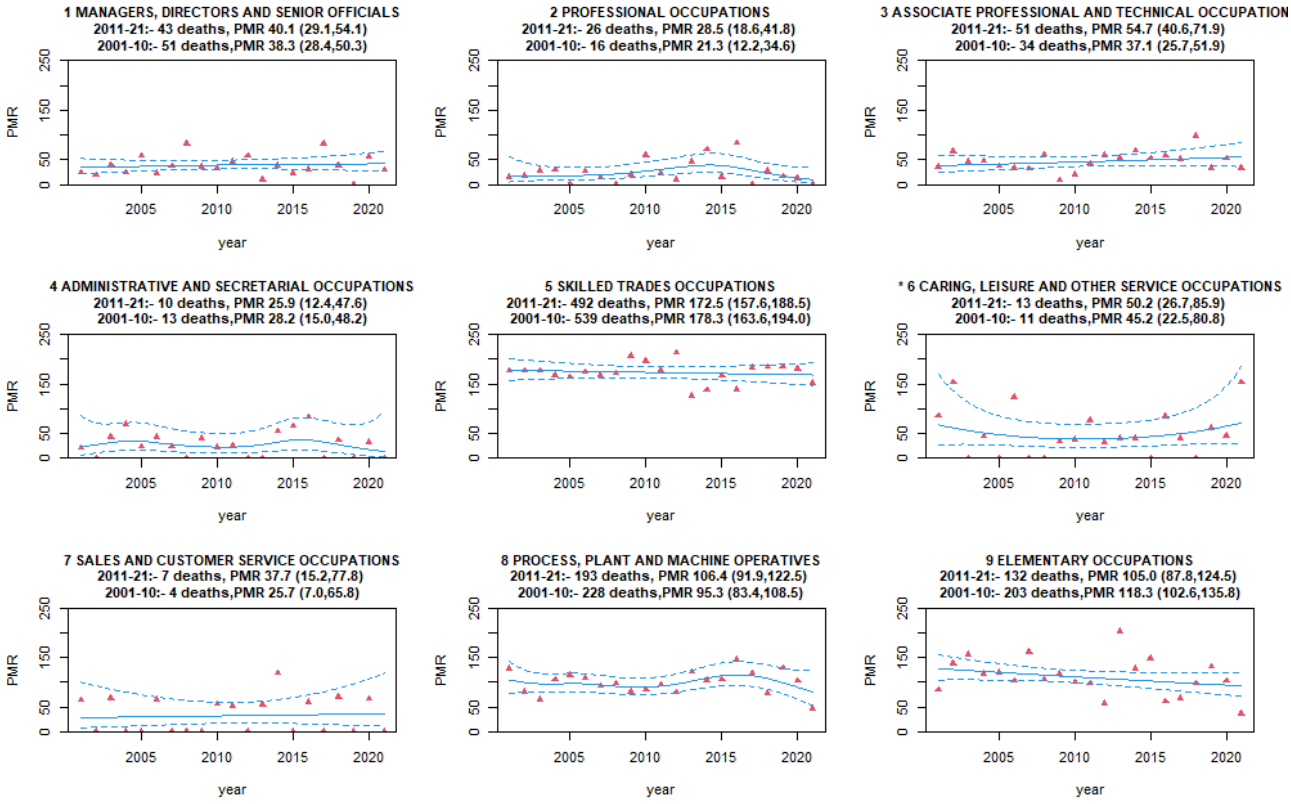


Figure A3.1: Asbestosis PMRs by SOC major group, males, 2001-2021

SOC major group (1-digit)

Among males, major group 5 (Skilled trades occupations) was the only major group with statistically significantly elevated asbestosis mortality during 2011-2021 PMR 172.5, 95% CI 157.6 to 188.5, with 492 deaths amongst those aged 16-74, but with no significant trend. (PMR for 2011-2020: 169.6, 95% CI 154.3 to 185.9, and 454 deaths.) This major group contains a number of more specific codes with significantly elevated PMRs, including the two of the four elevated 2-digit sub-major group codes, four of the seven

highest ranking 3-digit minor group codes and nine of the thirteen highest ranking 4-digit unit codes.

Six out of the remaining eight major groups have significantly lower PMRs compared to the average for all occupations, the exceptions being group 8 (Process, plant and machine operatives) and group 9 (Elementary occupations), which are not significantly elevated but do contain the only other sub groupings that are.

SOC sub-major group (2-digit)

There were four statistically significantly elevated sub-major occupational groupings in the period 2011-2020 for males:

- Group 53: Skilled construction and building trades 307 deaths, PMR 282.3, 95% CI 251.6 to 315.7, with no trend. (PMR 2011-2020: 274.8, 95% CI 243.6 to 309.0, with 280 deaths.)
- Group 81: Process, plant and machine operatives 127 deaths, PMR 169.7, 95% CI 141.5 to 201.9, with no trend. (PMR 2011-2020: 171.6, 95% CI 142.6 to 204.8, with 123 deaths.)
- Group 91: Elementary trades and related occupations 89 deaths, PMR 162.1, 95% CI 130.2 to 199.5, with no trend. (PMR 2011-2020: 164.6, 95% CI 131.5 to 203.5, with 85 deaths.)
- Group 52: Skilled metal, electrical and electronic trades (167 deaths, PMR 143.2, 95% CI 122.3 to 166.6, with a decreasing trend. (PMR 2011-2020: 143.9, 95% CI 122.3 to 168.2, with 158 deaths.)

The corresponding SOC2000 codes for 2001-2010 were also similarly elevated.

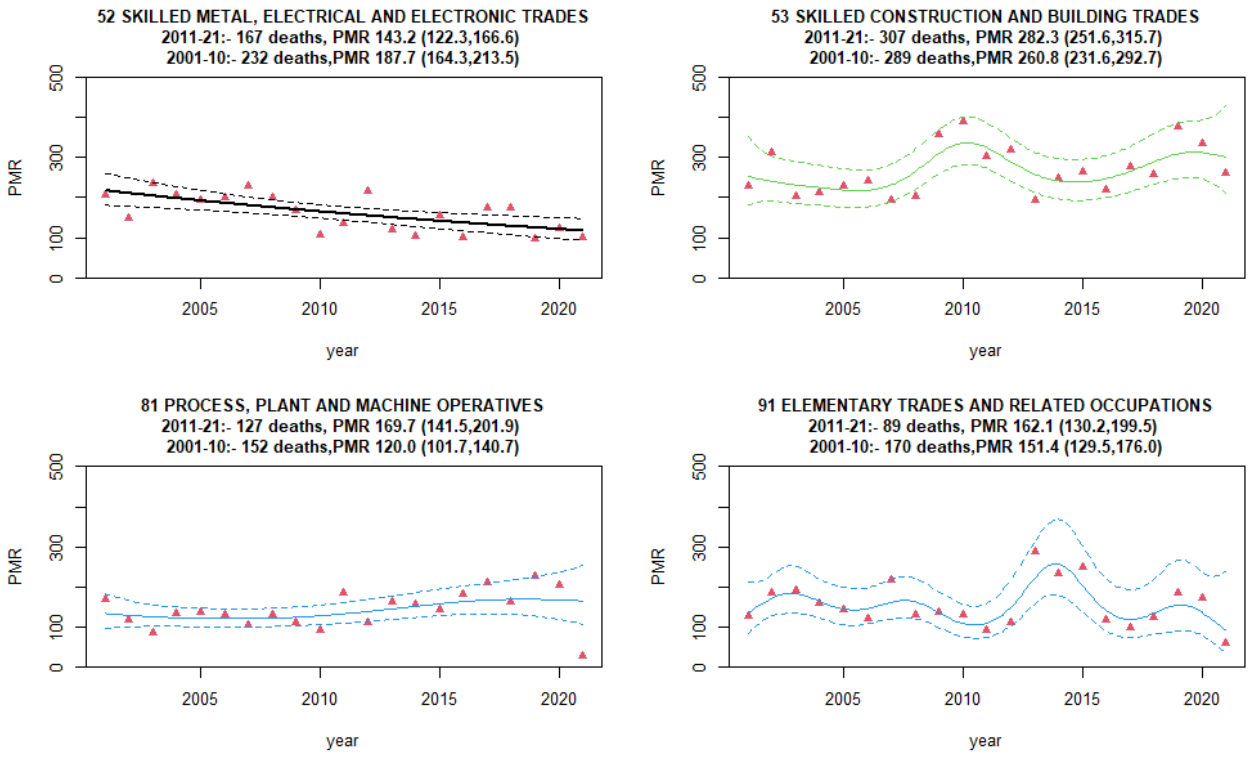


Figure A3.2: Asbestosis PMRs by SOC sub-major group, males, 2001-2020

SOC minor group (3-digit)

For males, asbestosis PMRs for seven SOC minor groups were statistically significantly elevated for the period 2011-2021, all of which have at least some association with building-related activities:

- Group 814: Construction Operatives (PMR 437.6, 95% CI 331.4 to 567.0, with 57 deaths)
- Group 531: Construction and Building Trades (PMR 309.2, 95% CI 272.2 to 350.0, with 251 deaths)
- Group 521: Metal Forming, Welding and Related Trades (PMR 265.8, 95% CI 192.3 to 358.0, with 43 deaths)
- Group 912: Elementary Construction Occupations (PMR 235, 95% CI 177.0 to 305.9, with 55 deaths)
- Group 532: Building Finishing Trades (PMR 206.0, 95% CI 153.9 to 270.2, with 52 deaths)
- Group 524: Electrical and Electronic Trades (PMR 143.1, 95% CI 107.5 to 186.7, with 54 deaths) with some evidence of a downward trend
- Group 812: Plant and Machine Operatives (PMR 142.7, 95% CI 106.6 to 187.2, with 52 deaths).

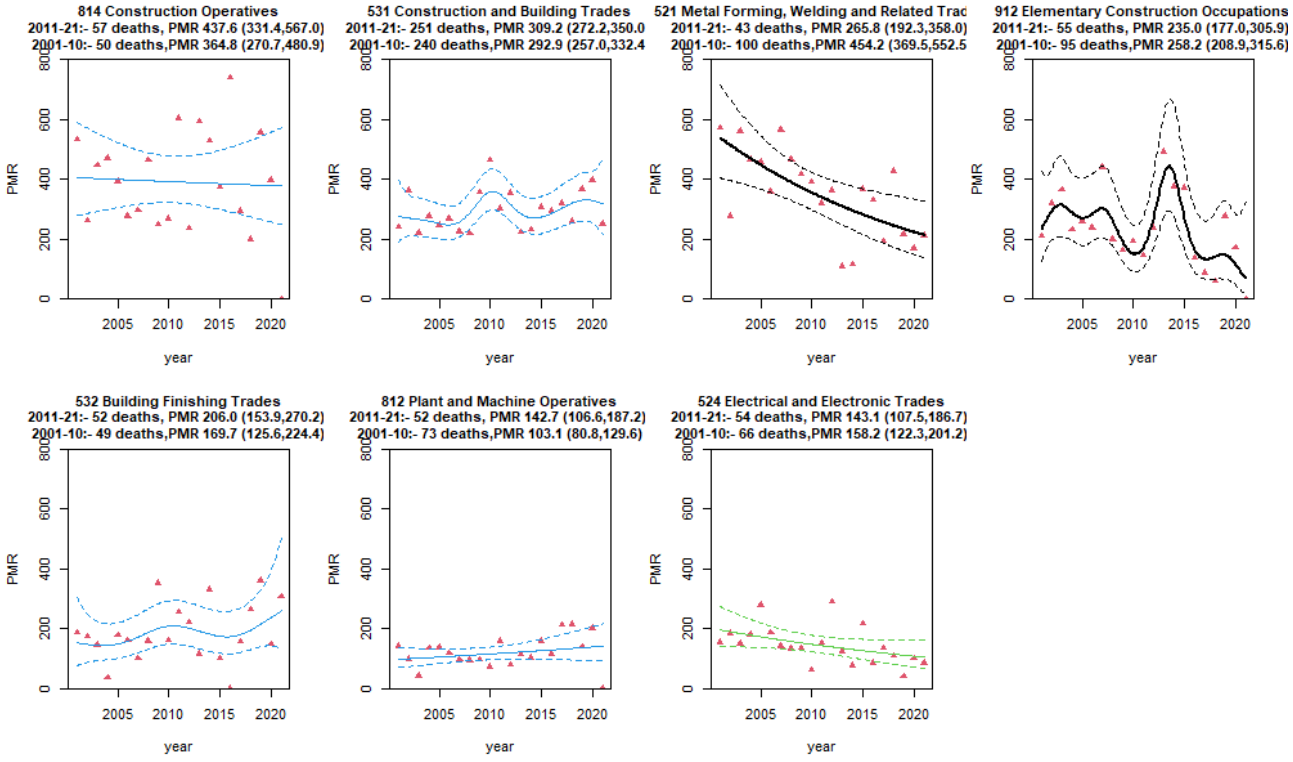


Figure A3.3: Asbestosis PMRs by SOC minor group, males, 2001-2021

SOC unit group (4-digit)

For males, PMRs were statistically significantly elevated for 13 of the 186 SOC unit groups with at least 10 observed or expected non-mesothelioma asbestosis deaths. Results for these groups are listed below. Again, a substantial proportion of these unit groups were associated with building activities.

Unit groups with the highest PMRs:

- Group 5216: Pipe fitters (PMR 905.9, 95% CI 527.6 to 1450.5, with 17 deaths)
- Group 5236: Boat and ship builders and repairers (PMR 624.2, 95% CI 363.5 to 999.5, with 17 deaths)
- Group 8149: Construction operatives n.e.c. (PMR 589.5, 95% CI 417.2 to 809.2, with 38 deaths)
- Group 8141: Scaffolders, stagers and riggers (PMR 493.1, 95% CI 276.2 to 813.3, with 15 deaths)
- Group 5314: Plumbers and heating and ventilating engineers (PMR 465.8, 95% CI 361.7 to 590.5, with 68 deaths)
- Group 5315: Carpenters and joiners (PMR 406.3, 95% CI 327.1 to 498.8, with 91 deaths)
- Group 5313: Roofers, roof tilers and slaters (PMR 377.2, 95% CI 219.7 to 604.0, with 17 deaths)
- Group 9120: Elementary construction occupations (PMR 235.0, 95% CI 177.0 to 305.9, with 55 deaths)
- Group 5323: Painters and decorators (PMR 215.1, 95% CI 152.9 to 294.0, with 39 deaths)
- Group 5319: Construction and building trades n.e.c. (PMR 201.6, 95% CI 152.3 to 261.8, with 56 deaths)
- Group 5215: Welding trades (PMR 197.1, 95% CI 114.8 to 315.6, with 17 deaths)
- Group 5241: Electricians and electrical fitters (PMR 188.1, 95% CI 137.2 to 251.7, with 45 deaths)
- Group 8125: Metal working machine operatives (PMR 187.1, 95% CI 125.3 to 268.7, with 29 deaths).

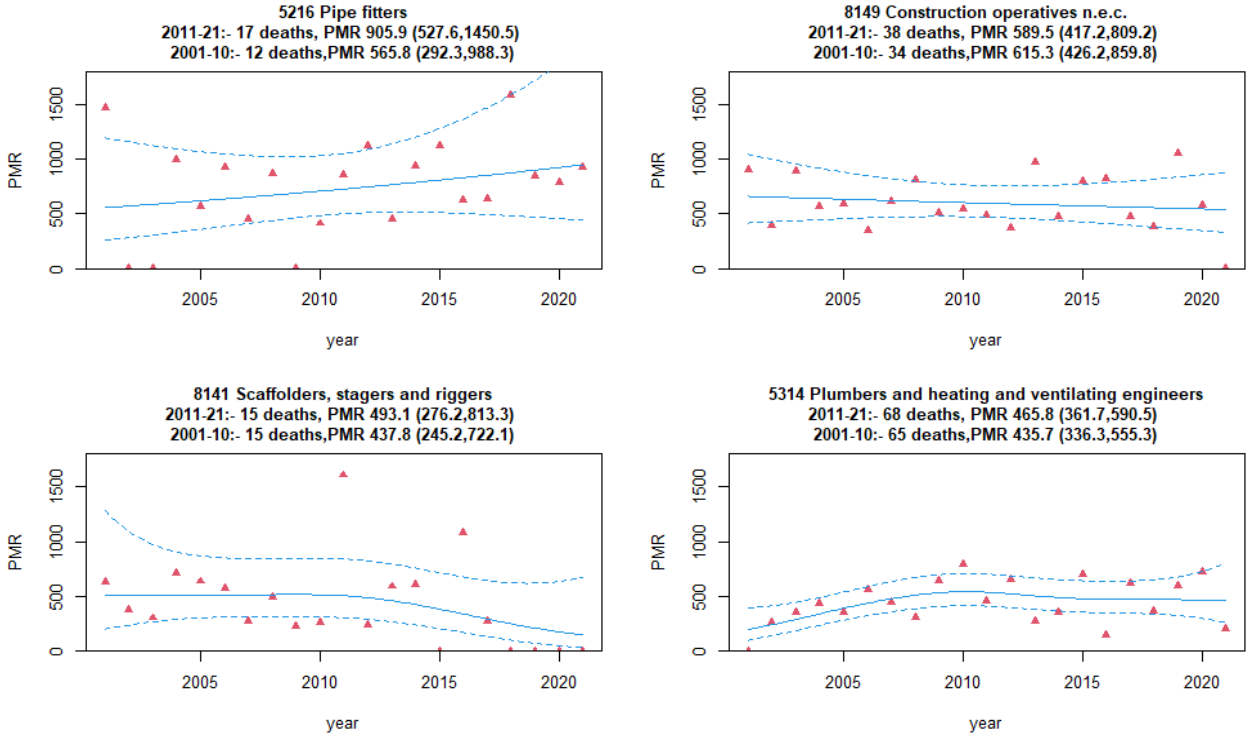


Figure A3.4a: Asbestosis PMRs by SOC unit group, males, 2001-2021

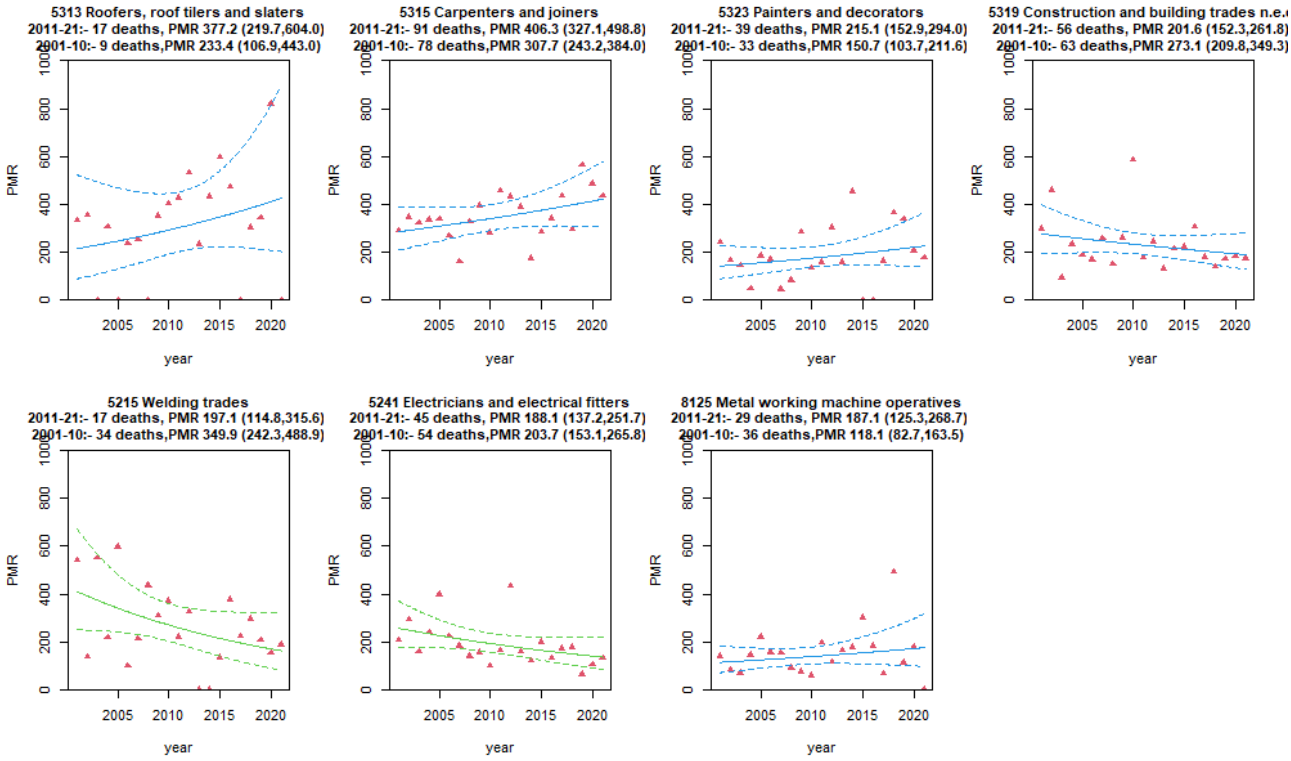


Figure A3.4b: Asbestosis PMRs by SOC unit group, males, 2001-2021

There is no evidence of trends over time for the 11 unit groups shown in the graphs above, with the exception of unit groups 5215 (Welding trades) and 5241 (Electricians and electrical fitters) where a downward trend was of borderline statistical significance. Two of the 13 unit groups could not be shown because of differences between SOC2000 and SOC2010 coding: unit group 5236: Boat and ship builders and repairers (17 deaths, PMR=624.2, 95% CI: 377.5, 1038.0); and unit group 9120: Elementary construction occupations (53 deaths, PMR=241.1, 95% CI: 363.5, 999.5). Within unit group 9120, laggers accounted for 23 out of the 55 deaths (with an all-cause deaths total of 31,547). In contrast, for the previous ten years that is the SOC2000 period 2001-2010, laggers accounted for 46 out of 52 deaths for the highest ranked unit group 9129: Labourers in other construction trades n.e.c. (PMR=2296.5, 95% CI: 1715.3, 3011.5, all-cause deaths total 2181).

Annex 4 – Impact of the coronavirus pandemic

Assessment of the impact of the coronavirus pandemic on asbestosis deaths registered during 2020-2023

Statistics for asbestosis deaths occurring in years 2020 and 2021 may have been affected by the coronavirus pandemic for various reasons. These include direct effects (individuals with asbestosis – whether or not diagnosed – dying earlier than otherwise due to also developing COVID-19), and indirect effects due to factors affecting health services, and effects on systems for recording and certifying deaths. For example, some deaths where both COVID-19 and asbestosis played a role may have been less likely to be attributed to asbestosis as the underlying cause of death than if the pandemic had not occurred. In the case of asbestosis, pressures on the death certification system do not have appeared to have delayed the registration of many deaths beyond the cut-off for inclusion in the initial release of the statistics.

Deaths occurring in 2020 and 2021 where death certificates mentioned both asbestosis and COVID-19

Figure A1.1 shows the 530 asbestos deaths (excluding deaths that also mentioned mesothelioma) occurring in 2020 and the 537 such deaths in 2021 by month of occurrence (red line) compared with the average annual deaths occurring in each month for deaths in the period 2015-19 (blue line repeated across both years).

There is some evidence of an excess of deaths in April 2020 and December 2020 to February 2021, periods that coincided with waves of the coronavirus pandemic. However, there is also a suggestion of deficits in other months between, particularly in June of both years. This crude comparison suggests that there may have been some additional deaths where both COVID-19 and asbestosis played a role in the deaths occurring in 2020 and 2021, and some of these cases may have occurred in later years had the pandemic not occurred.

The chart also shows the 116 deaths in 2021 and 112 in 2020 where the death certificate mentioned both asbestosis and COVID-19 (black bars), the majority of which (104 and 103 respectively) had COVID-19 recorded as the underlying cause of death. These deaths again occurred in months that coincided with the first two waves of the pandemic. It is possible that some of these deaths may have occurred in later years had the pandemic not occurred.

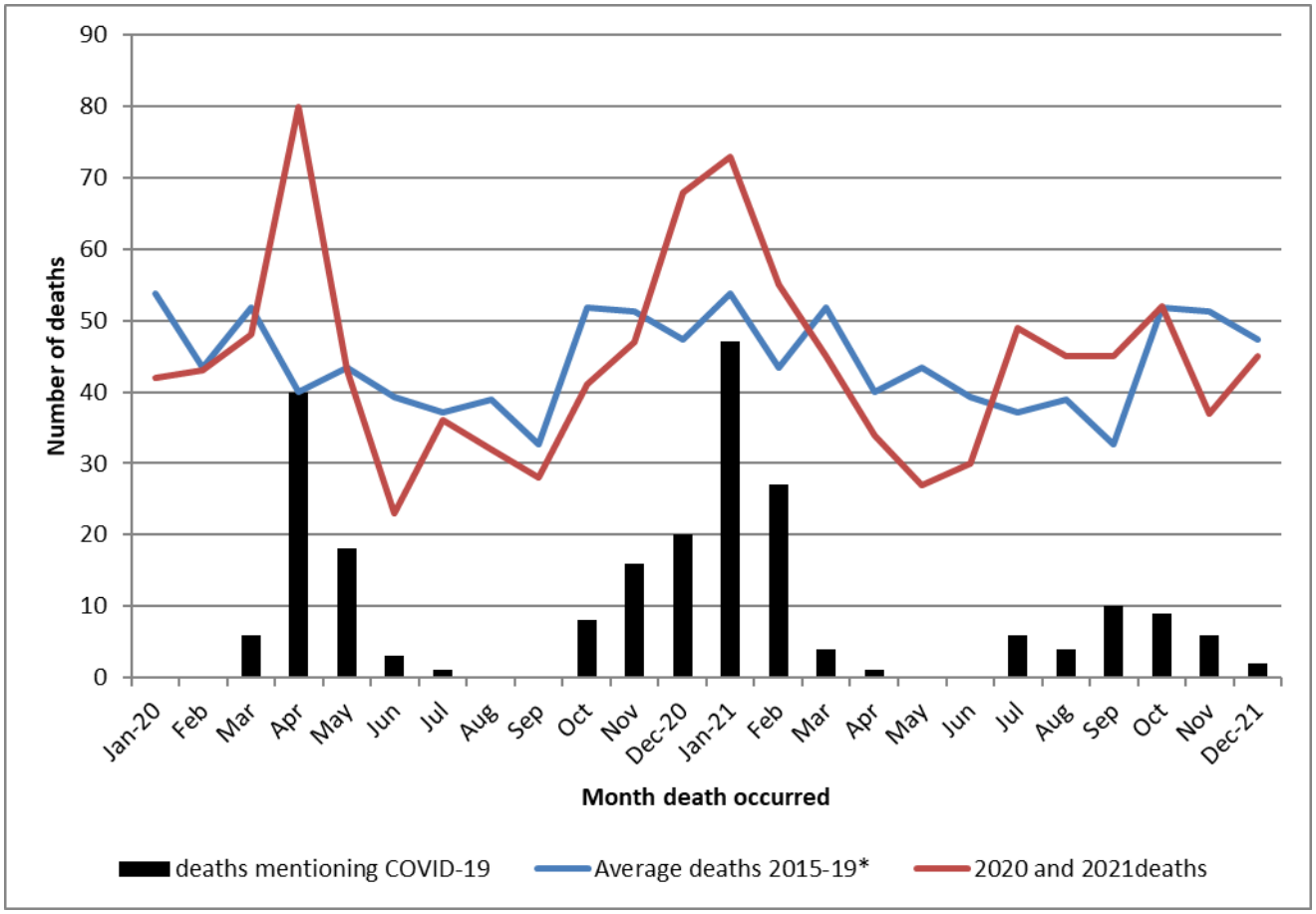


Figure A4.1: Comparison of asbestosis deaths (excluding those that mentioned mesothelioma) occurring in 2020 and 2021 with the average for the previous 5 years, and deaths mentioning both asbestosis and COVID-19, by month of death

Figure A1.2 shows a similar chart but restricted to deaths where asbestosis was recorded as the underlying cause of death. In this case it is more difficult to determine whether COVID-19 deaths have resulted in excesses in some months due to the increased variability in the monthly data caused by smaller counts. Since there can only be one underlying cause of death on the death certificate, all of the relatively small number of deaths that also specifically mentioned COVID-19 (black bars) mentioned this as an associated cause of death. Again, some of these deaths may have occurred after 2020 had the pandemic not occurred.

Finally, it is also possible that some deaths where both COVID-19 and asbestosis played a role where less likely to be recorded as asbestosis as the underlying cause of death than if the pandemic had not occurred. This may account for some of the reduction in the number of deaths seen in 2020 and 2021. (There were 189 such deaths in 2020 and 166 in 2021 vs 219 in 2019.)

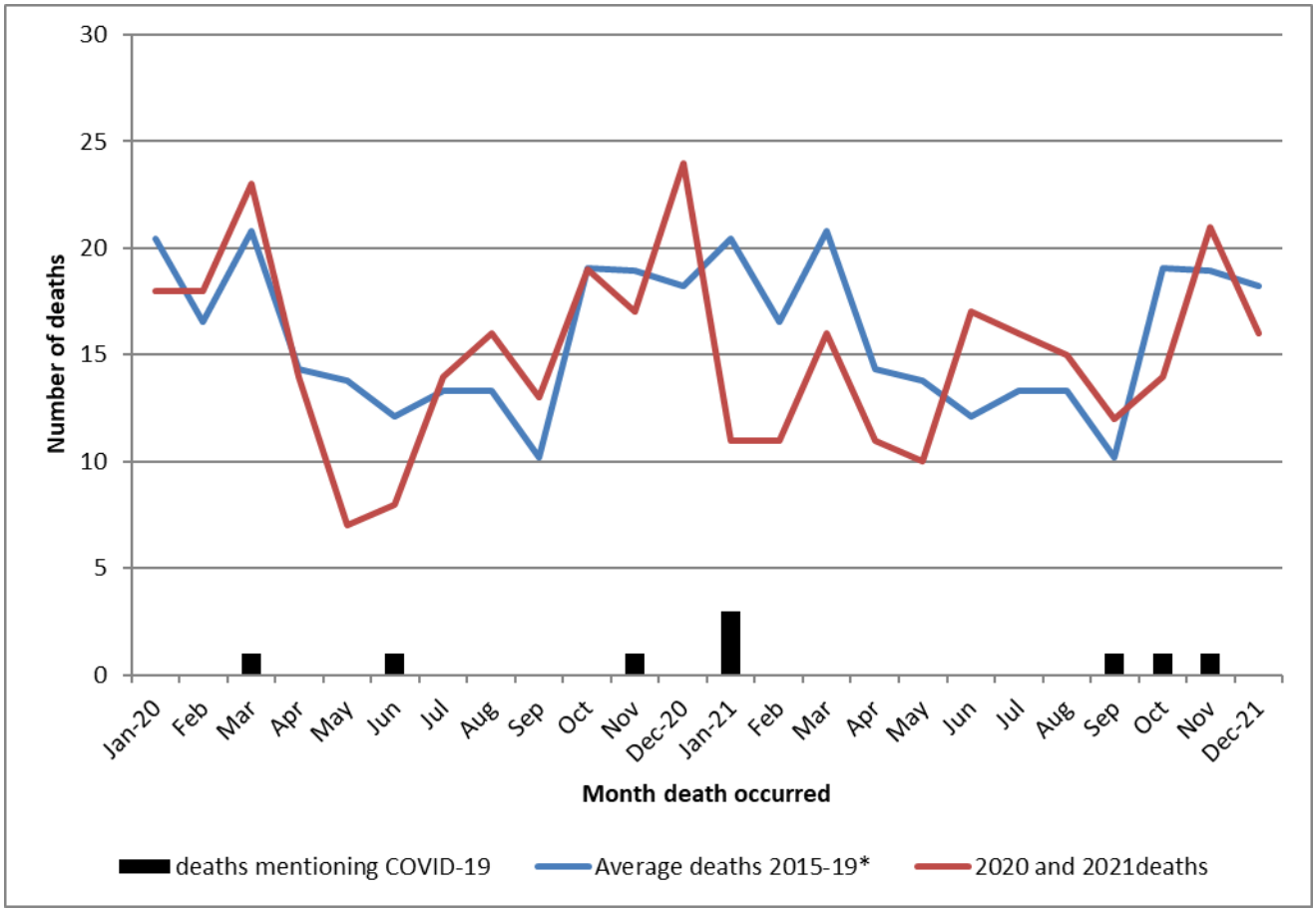


Figure A4.2: Comparison of deaths with asbestosis as the underlying cause occurring in 2020 and 2021 with the average for the previous 5 years, and deaths mentioning both asbestosis and COVID-19, by month of death

Comparison of timing in death registrations for deaths occurring pre- and post-pandemic

Table A1.1 shows a breakdown of asbestos deaths occurring in the 5-year period 2014-2018 and deaths occurring in 2019, 2020 and 2021 by month the death was registered (excluding deaths that also mentioned mesothelioma). A small number of deaths occurring in 2019 and a majority of those occurring in 2020 and 2021 were registered during the pandemic when there could have been unusual pressures on the death certification system.

Based on data for deaths occurring during the five-year period 2014-18, 74.3% of asbestosis deaths were registered by the end of December of the year in which the death occurred, with 24.8% registered the following year, and 1.3% registered in the first three months of the year after that (up to the end of March, 15 months after the end of the year in which the death occurred). Very few deaths are usually registered after this point, which is the cut-off for inclusion in the statistics when they are first released.

An analysis of late registrations for asbestosis deaths occurring in 2019 does not suggest any strong effect on the number of late registrations during April to June 2020, the period coinciding with the first wave of the coronavirus pandemic. Fewer deaths than usual were registered overall in the year that the death occurred (69.9%), and more were registered in the year following the year of the death (27.1%) By March 2023 there were an additional 12 deaths in 2019 registered after March 2021, which is higher than usual but small in absolute terms from a statistical perspective. Overall, while the pandemic may have caused some delays in asbestosis deaths being registered, the vast majority of deaths were still registered before the cut-off for inclusion in the statistics when first published.

For deaths occurring in 2020, more deaths were registered than usual in April 2020, but fewer in June 2020 (months that coincided with the first wave of the pandemic). For deaths occurring in 2021, more deaths were registered than usual in February 2021 (coinciding with the ‘alpha’ wave). However, for both years taken as a whole, the pattern of registrations is similar to that for 2014-18, and only 5 additional deaths occurring in 2020 were registered after March 2022 (the cut-off for inclusion in the statistics when first published). Taken together this suggests that the number of additional late registrations deaths that occurred in 2021 not already included in these statistics (i.e. registered by March 2023) is likely to be minimal.

Table A4.1 Deaths occurring in 2014-18, 2019 and 2020 by month of registration

	Year death occurred								
Deaths registered during:	2014	2015	2016	2017	2018	*Average 2014-2018*	2019	2020	2021
Year death occurred									
January	14	14	12	12	17	*13.8*	8	18	29
February	18	14	21	21	18	*18.4*	16	17	40
March	16	18	29	22	19	*20.8*	20	23	28
April	24	28	27	19	23	*24.2*	25	62	34
May	27	21	36	40	32	*31.2*	28	40	27
June	25	40	34	45	41	*37.0*	24	17	28
July	45	44	31	30	26	*35.2*	39	33	33
August	30	31	38	33	45	*35.4*	37	30	37
September	37	34	34	32	32	*33.8*	24	36	39
October	35	41	37	39	43	*39.0*	36	31	34
November	23	36	42	43	42	*37.2*	42	47	37
December	36	29	39	28	39	*34.2*	49	48	31
Total	**330**	**350**	**380**	**364**	**377**	***360.2***	**348**	**402**	**397**
Percentage of all deaths	***75.7***	***74.8***	***76.0***	***70.8***	***74.5***	***74.3***	***69.9***	***76.4***	***73.9***
Year of death + 1									
January	20	20	28	26	25	*23.8*	25	21	25
February	22	29	27	23	23	*24.8*	32	21	18
March	13	13	20	20	19	*17.0*	23	14	19
April	14	22	11	28	17	*18.4*	8	18	16
May	14	12	9	15	13	*12.6*	10	11	12
June	3	7	8	12	7	*7.4*	12	7	17
July	4	4	7	6	4	*5.0*	5	7	6
August	4	4	4	5	5	*4.4*	7	2	4
September	0	3	2	3	4	*2.4*	3	5	7
October	5	0	1	3	2	*2.2*	3	3	5
November	1	0	0	3	3	*1.4*	3	5	1
December	0	1	0	2	2	*1.0*	4	4	1
Total	**100**	**115**	**117**	**146**	**124**	***120.4***	**135**	**118**	**131**
Percentage of all deaths	***22.9***	***24.6***	***23.4***	***28.4***	***24.5***	***24.8***	***27.1***	***22.2***	***24.4***
Year of death + 2									
January - March	1	2	1	2	1	*1.4*	5	6	9
April - December	3	1	2	2	3	*2.2*	7	5	0
Total	**4**	**3**	**3**	**4**	**4**	***3.6***	**12**	**11**	**9**
Percentage of all deaths	***0.9***	***0.6***	***0.6***	***0.8***	***0.8***	***0.7***	***2.4***	***2.1***	***1.7***
Later than Year of death + 2									
Total	**2**	**0**	**0**	**0**	**1**	***0.6***	**3**	**0**	**0**
Grand Total	**436**	**468**	**500**	**514**	**506**	**484.8**	**498**	**531**	**537**

Annex 5: Figure A5.1 – Annual asbestosis deaths 1978-2021

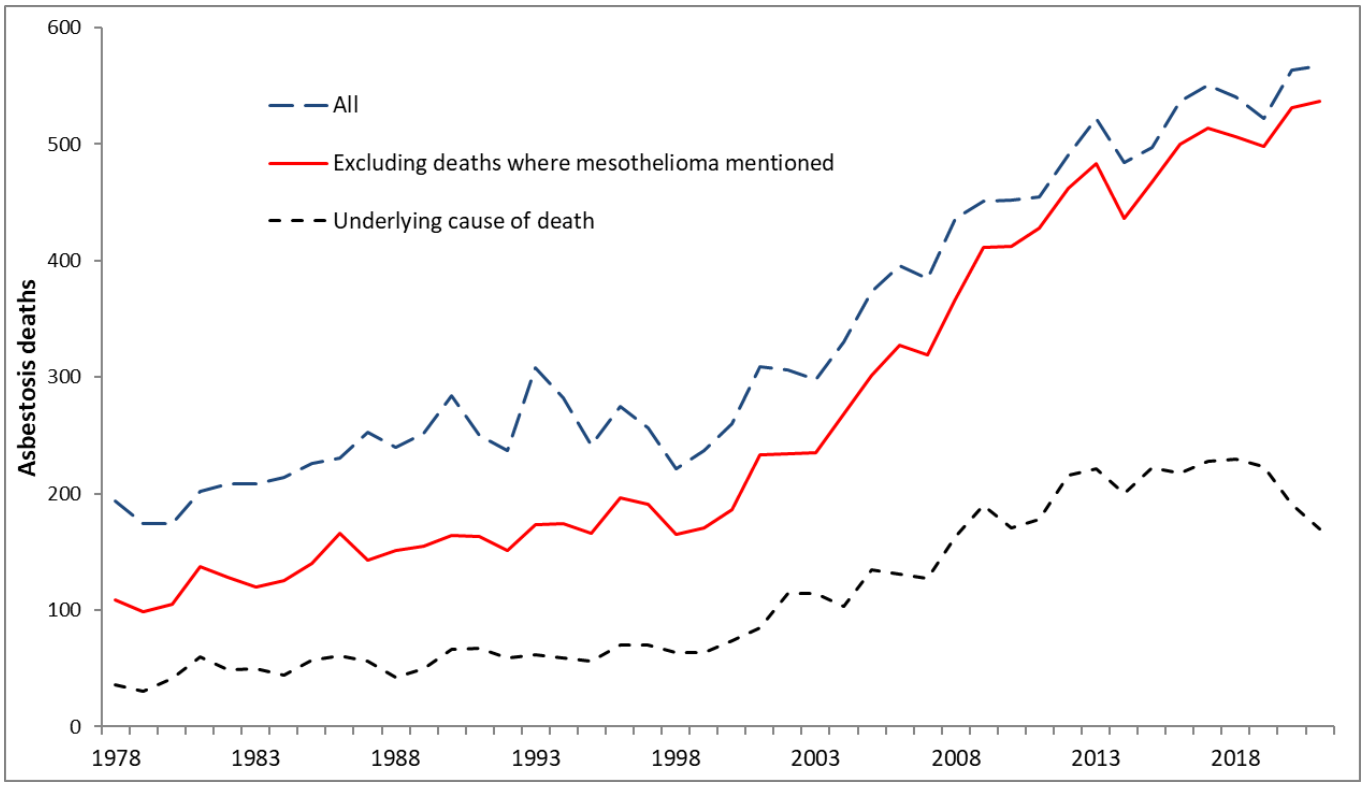


Figure A5.1 – Annual asbestosis deaths 1978-2021

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A revisions policy and log can be seen at www.hse.gov.uk/statistics/about/revisions/

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