Mortality trends in Asbestosis, Extrinsic Allergic Alveolitis and Sarcoidosis in England and Wales

A. Hanley, R.B. Hubbard, V. Navaratnam

Division of Epidemiology and Public Health, University of Nottingham, Nottingham NG5 1PB, UK
Nottingham Respiratory, Biomedical Research Unit, Nottingham City Hospital, Hucknall Road, Nottingham, NG5 1PB, UK

Received 7 April 2011; accepted 12 May 2011
Available online 24 June 2011

KEYWORDS
Interstitial lung disease; Clinical epidemiology; Asbestosis; Sarcoidosis; Extrinsic Allergic Alveolitis

Summary
Background: To ascertain the trends in mortality from Asbestosis, Extrinsic Allergic Alveolitis (EAA) and Sarcoidosis in England and Wales, we analysed mortality data from the Office of National Statistics.
Methods: We calculated age and stratum specific mortality rates between 1968 and 2008 and applied these to the 2008 population to generate annual standardised expected number of deaths. Poisson regression was used to calculate annual mortality rate ratios.
Results: From 1968 to 2008 there were 1958 registered deaths from Asbestosis, 878 deaths from EAA and 3544 deaths from Sarcoidosis. The Asbestosis mortality rate increased from 0.04 (95% CI 0.03–0.05) in the 1968–1972 calendar period to 0.12 (95% CI 0.10–0.13) in the 2005–2008 period whilst the mortality from EAA increased marginally from 0.04 (95% CI 0.03–0.05) in the 1968–1972 calendar period to 0.08 (95% CI 0.07–0.09) in the 2005–2008 period. Mortality from Sarcoidosis increased by approximately 9% a year.
Discussion: Our findings show that the mortality from Asbestosis continues to rise in the UK. Overall mortality rates from EAA remained stable throughout the same period but it was higher in males and in older people. There was a slight increase in mortality from Sarcoidosis over the study period which was greater in women.

Introduction

Asbestosis, Extrinsic Allergic Alveolitis (EAA) and Sarcoidosis are three of the more common types of interstitial lung disease that present to respiratory outpatient clinics, but there is limited information available on the mortality trends for these conditions. Using registered death certificates to examine the mortality trends over time is an established method of examining the burden of a disease, and has been used
previously in interstitial lung disease, more specifically, cryptogenic fibrosing alveolitis and idiopathic pulmonary fibrosis.\textsuperscript{1–3}

The aim of this study is to investigate the mortality rates of Asbestosis, Extrinsic Allergic Alveolitis and Sarcoidosis, stratified by age and sex in England and Wales and to determine if mortality from these three diseases had changed over time.

Methods

Data collection

We used routine mortality data from the Office of National Statistics (ONS), which is derived from registered death certificates and coded for the underlying cause of deaths. This dataset is available on CD-ROM and can be obtained electronically from the ONS’s website (www.ons.gov.uk). Over this period of time, three different ICD codes were used to code death from Asbestosis, Extrinsic Allergic Alveolitis (EAA) and Sarcoidosis (see Table 1).

Data analysis

Annual number of deaths from Asbestosis, EAA and Sarcoidosis were obtained for the years 1968–2008 stratified by age and sex. We used the total population from England and Wales for each disease for the years 1968–2008 as our denominators.

For these analyses, the data on registered deaths and the general population were grouped in approximately 5 year periods but without combining the different ICD codes. Data for Asbestosis and EAA was also grouped into 5 year age bands.

Table 1: International Classification of Diseases codes used to extract the mortality data from the Office of National Statistics.

<table>
<thead>
<tr>
<th>Disease</th>
<th>ICD Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asbestosis</td>
<td>ICD-8 515.2 Asbestosis</td>
</tr>
<tr>
<td></td>
<td>ICD-9 501 Asbestosis</td>
</tr>
<tr>
<td></td>
<td>ICD-10 J61 Pneumoconiosis due to asbestos and other mineral fibres</td>
</tr>
<tr>
<td></td>
<td>J92.0 Pleural plaque with presence of asbestos</td>
</tr>
<tr>
<td>Extrinsic Allergic Alveolitis</td>
<td>ICD-8 516.1 Other pneumoconiosis and related diseases due to inhalation</td>
</tr>
<tr>
<td></td>
<td>of other dust</td>
</tr>
<tr>
<td></td>
<td>ICD-9 495.0 Farmer’s lung</td>
</tr>
<tr>
<td></td>
<td>495.1 Bagassosis</td>
</tr>
<tr>
<td></td>
<td>495.2 Bird fancier’s lung</td>
</tr>
<tr>
<td></td>
<td>495.3 Suberosis</td>
</tr>
<tr>
<td></td>
<td>495.4 Maltworker’s lung</td>
</tr>
<tr>
<td></td>
<td>495.5 Mushroom worker’s lung</td>
</tr>
<tr>
<td></td>
<td>495.6 Maple-Bark-Stripper’s lung</td>
</tr>
<tr>
<td></td>
<td>495.7 ’Ventilation’ pneumonitis</td>
</tr>
<tr>
<td></td>
<td>495.8 Other specified allergic Alveolitis and pneumonitis</td>
</tr>
<tr>
<td></td>
<td>495.9 Unspecified allergic Alveolitis and pneumonitis</td>
</tr>
<tr>
<td></td>
<td>ICD-10 J67.0 Farmer’s lung</td>
</tr>
<tr>
<td></td>
<td>J67.1 Bagassosis</td>
</tr>
<tr>
<td></td>
<td>J67.2 Bird fancier’s lung</td>
</tr>
<tr>
<td></td>
<td>J67.3 Suberosis</td>
</tr>
<tr>
<td></td>
<td>J67.4 Maltworker’s lung</td>
</tr>
<tr>
<td></td>
<td>J67.5 Mushroom worker’s lung</td>
</tr>
<tr>
<td></td>
<td>J67.6 Maple-Bark-Stripper’s Lung</td>
</tr>
<tr>
<td></td>
<td>J67.7 Air conditioner and humidifier lung</td>
</tr>
<tr>
<td></td>
<td>J67.8 Hypersensitivity pneumonitis due to other organic dust</td>
</tr>
<tr>
<td></td>
<td>J67.9 Hypersensitivity pneumonitis due to unspecified organic dust</td>
</tr>
<tr>
<td>Sarcoidosis</td>
<td>ICD-8 135 Sarcoidosis</td>
</tr>
<tr>
<td></td>
<td>ICD-9 135 Sarcoidosis</td>
</tr>
<tr>
<td></td>
<td>ICD-10 517.8 Lung involvement in other diseases classified elsewhere</td>
</tr>
<tr>
<td></td>
<td>D86.0 Sarcoidosis of the lung</td>
</tr>
<tr>
<td></td>
<td>D86.1 Sarcoidosis of lymph nodes</td>
</tr>
<tr>
<td></td>
<td>D86.2 Sarcoidosis of the lung with Sarcoidosis of lymph nodes</td>
</tr>
<tr>
<td></td>
<td>D86.3 Sarcoidosis of skin</td>
</tr>
<tr>
<td></td>
<td>D86.8 Sarcoidosis of other and combined sites</td>
</tr>
<tr>
<td></td>
<td>D86.9 Sarcoidosis, unspecified</td>
</tr>
</tbody>
</table>
over the age of 55 years and data for Sarcoidosis was grouped into 5 year age bands over the age of 35 years. We calculated age and sex stratum specific mortality rates for each year and then applied these rates to the 2008 population to generate annual standardised mortality numbers.

Poisson regression modelling was used to estimate annual mortality rate ratios with adjustment for sex and age. A multiplicative interaction term was used to test for interactions between mortality rates in the different calendar periods and age or sex.

**Results**

**Asbestosis**

There were 1958 deaths attributed to Asbestosis in England and Wales from 1968 to 2008. The number of recorded deaths increased from 13 (11 after standardisation to the 2008 population) in 1968 to 129 (124 after standardisation) in 2006 (see Fig. 1). There was a sharp decline in the number of deaths in 2007 (5 deaths) and 2008 (3 deaths) which does not fit with the overall trend of deaths seen and is likely to be an error in coding of death registrations. The overall mortality rate for the study period was 0.09 per 100,000 person years (95% CI 0.08–0.09), with the mortality rate increasing from 0.04 per 100,000 person years (95% CI 0.03–0.05) in the 1968–1972 calendar period to 0.12 per 100,000 person years (95% CI 0.10–0.13) in the 2005–2008 calendar period. After adjusting for age and sex, the number of deaths from Asbestosis had increased by threefold during the study period. Mortality from Asbestosis was found to be higher in men compared to women, and also higher with increasing age categories.

There was evidence of a statistical interaction to suggest that the increase in mortality rates over time were higher in the older population \(p < 0.001\) and in men \(p < 0.001\). The age group specific mortality rate ratios were 0.76 (95% CI 0.69–0.85) for individuals aged 0–54, for 0.86 (95% CI 0.80 to 0.93) in individuals aged 55–59 years, 1.00 (95% CI 0.94–1.06) in individuals aged 60–64 years, 1.20 (95% CI 1.13–1.28) in individuals aged 65–69 years, 1.50 (95% CI 1.42–1.58) in individuals aged 70–74 years, 1.76 (95% CI 1.69–1.83) in individuals aged 75–79 years, 1.64 (95% CI 1.57–1.72) in individuals aged 80–84 years, and 1.21 (95% CI 1.13–1.29) in individuals aged 85 and above.

**Table 2** Standardised mortality rates and Poisson regression modelling of deaths from Asbestosis.

<table>
<thead>
<tr>
<th>Calendar period</th>
<th>Ndths (million)</th>
<th>Person-years (100 000)</th>
<th>Mortality rate (standardised to 2008 pop per 100,000 (95% confidence interval))</th>
<th>Mutually adjusted rate ratios (95% confidence intervals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICD-8 1968–1972</td>
<td>102 270</td>
<td>0.04 (0.03–0.05)</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>1973–1978</td>
<td>168 330</td>
<td>0.05 (0.04–0.06)</td>
<td>1.37 (1.07–1.76)</td>
<td></td>
</tr>
<tr>
<td>1979–1983</td>
<td>173 270</td>
<td>0.06 (0.06–0.07)</td>
<td>1.70 (1.33–2.17)</td>
<td></td>
</tr>
<tr>
<td>ICD-9 1984–1988</td>
<td>209 270</td>
<td>0.08 (0.07–0.09)</td>
<td>2.05 (1.66–2.60)</td>
<td></td>
</tr>
<tr>
<td>1989–1994</td>
<td>331 330</td>
<td>0.10 (0.09–0.11)</td>
<td>2.70 (2.17–3.38)</td>
<td></td>
</tr>
<tr>
<td>1995–2000</td>
<td>335 330</td>
<td>0.10 (0.09–0.11)</td>
<td>2.74 (2.19–3.42)</td>
<td></td>
</tr>
<tr>
<td>ICD-10 2001–2004</td>
<td>385 220</td>
<td>0.18 (0.16–0.20)</td>
<td>4.72 (3.79–5.87)</td>
<td></td>
</tr>
<tr>
<td>2005–2008</td>
<td>255 220</td>
<td>0.12 (0.10–0.13)</td>
<td>3.13 (2.48–3.93)</td>
<td></td>
</tr>
</tbody>
</table>

Sex

<table>
<thead>
<tr>
<th>Ndths</th>
<th>Person–years (100 000)</th>
<th>Mortality rate (standardised to 2008 pop per 100,000 (95% confidence interval))</th>
<th>Mutually adjusted rate ratios (95% confidence intervals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>1785 110</td>
<td>0.16 (0.16–0.17)</td>
<td>1.00</td>
</tr>
<tr>
<td>Female</td>
<td>173 110</td>
<td>0.02 (0.01–0.02)</td>
<td>0.08 (0.07–0.09)</td>
</tr>
</tbody>
</table>

Age group (years)

<table>
<thead>
<tr>
<th>Ndths</th>
<th>Person–years (100 000)</th>
<th>Mortality rate (standardised to 2008 pop per 100,000 (95% confidence interval))</th>
<th>Mutually adjusted rate ratios (95% confidence intervals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–54</td>
<td>92 160</td>
<td>0.01 (0.01–0.01)</td>
<td>0.02 (0.01–0.02)</td>
</tr>
<tr>
<td>55–59</td>
<td>140 130</td>
<td>0.11 (0.09–0.13)</td>
<td>0.32 (0.27–0.39)</td>
</tr>
<tr>
<td>60–64</td>
<td>231 130</td>
<td>0.17 (0.15–0.20)</td>
<td>0.53 (0.45–0.63)</td>
</tr>
<tr>
<td>65–69</td>
<td>322 100</td>
<td>0.32 (0.29–0.36)</td>
<td>1.00</td>
</tr>
<tr>
<td>70–74</td>
<td>412 870</td>
<td>0.47 (0.43–0.52)</td>
<td>1.50 (1.30–1.73)</td>
</tr>
<tr>
<td>75–79</td>
<td>382 720</td>
<td>0.53 (0.48–0.59)</td>
<td>1.76 (1.52–2.04)</td>
</tr>
<tr>
<td>80–84</td>
<td>242 530</td>
<td>0.45 (0.40–0.52)</td>
<td>1.64 (1.39–1.94)</td>
</tr>
<tr>
<td>85 and above</td>
<td>137 490</td>
<td>0.28 (0.23–0.33)</td>
<td>1.21 (0.99–1.47)</td>
</tr>
</tbody>
</table>

All the mortality rate ratios are mutually adjusted for all other variables in the table.
Mortality rate ratio for men was 1.06 (95% CI 1.02–1.09) in individuals aged 75–79 years, 1.64 (95% CI 1.52–1.77) in individuals between 80 and 84 years and 1.80 (95% CI 1.61–2.00) who are 85 years or above. The mortality rate ratios for men and women were 1.23 (95% CI 1.21–1.26) and 0.90 (95% CI 0.84–0.97) respectively (Table 2).

Extrinsic Allergic Alveolitis

There were 878 deaths from EAA over the study period. The mortality rate over time for EAA was stable throughout. Mortality rates were higher in men at 0.05 per 100 000 (95% CI 0.04–0.06) compared to women (see Table 3). Mortality rates also increased with age until a peak in the 80–84 age group with a rate of 0.19 per 100 000 (95% CI 0.15–0.23). There was evidence of a statistical interaction to suggest that the increase in mortality rates over time was higher in the older population (p < 0.001) and in men (p = 0.0078).

For individuals aged under 55 years, the age group specific mortality rate ratio was 1.02 (95% CI 0.94–1.11), for individuals in the 60–64 age group it was 0.96 (95% CI 0.89–1.05), and for those in the 65–69 age group the rate ratio was 1.01 (95% CI 0.93–1.08). For individuals between 70 and 74 years, the rate ratio was 1.11 (95% CI 1.03–1.19). Individuals aged 75–79 years had a rate ratio of 1.23 (95% CI 1.13–1.33), in those aged 80–84 years it was 1.30 (95% CI 1.18–1.43) and for individuals over 85 years it was 1.71 (95% CI 1.43–2.05). The mortality rate ratio for men was 1.06 (95% CI 1.02–1.10), and was 1.21 (95% CI 1.14–1.27) in women (Fig. 2).

Sarcoidosis

There were 3544 deaths from Sarcoidosis and a slight increase in mortality rates throughout the study period, increasing from 0.12 (95% CI 0.11–0.13) per 100 000 person years in the 1968–1972 calendar period to 0.22 (95% CI 0.20–0.24) per 100 000 person years. After controlling for the effects of sex and age, we calculated that the overall year on year increase in mortality was approximately 9% (rate ratio 1.09, 95% CI 1.07–1.10). Mortality was higher in females than males, and highest in individuals aged 60–79 years (see Table 4).

There was evidence of a statistical interaction to suggest that the increase in mortality rates over time were higher in the older population (P < 0.001). For individuals aged 0–34 years the age group specific rate ratio was 0.95 (95% CI 0.89–1.02). Individuals in the 40–44 age group had a rate ratio of 1.07 (95% CI 1.01–1.14), in those aged 45–49 years it was 1.01 (95% CI 0.95–1.07), for those aged 50–54 years it was 1.03 (95% CI 0.98–1.09), for those aged 55–59 years it was 1.04 (95% CI 1.00–1.09) and for those aged 60–64 years the rate ratio was 1.02 (95% CI 0.98–1.06). Those in the 65–69 age group had a rate ratio of 1.08 (95% confidence interval of 1.03–1.12), the 70–74 age group had a rate ratio of 1.16 (95% confidence interval of 1.11–1.21), those in the 75–79 age group had a rate ratio of 1.17 (95% confidence interval of 1.12–1.23) and those in the 80–84 age group had a rate ratio of 1.43 (95% confidence interval of 1.33–1.55). The rate ratio peaked in those aged 85 years and above with 1.52 (95% confidence interval of 1.35–1.71) (Fig. 3).

### Table 3 Standardised mortality rates and Poisson regression modelling of deaths from Extrinsic Allergic Alveolitis.

<table>
<thead>
<tr>
<th>Year period</th>
<th>Ndths (million)</th>
<th>Person–years (million)</th>
<th>Mortality rate (standardised to 2008 pop per 100 000 (95% confidence interval))</th>
<th>Mutually adjusted rate ratios (95% confidence intervals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICD-8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1968–1972</td>
<td>109</td>
<td>270</td>
<td>0.04 (0.03–0.05)</td>
<td>1.00</td>
</tr>
<tr>
<td>1973–1978</td>
<td>84</td>
<td>330</td>
<td>0.03 (0.02–0.03)</td>
<td>0.64 (0.48–0.85)</td>
</tr>
<tr>
<td>1979–1983</td>
<td>96</td>
<td>270</td>
<td>0.04 (0.03–0.04)</td>
<td>0.88 (0.67–1.16)</td>
</tr>
<tr>
<td>1984–1988</td>
<td>97</td>
<td>270</td>
<td>0.04 (0.03–0.04)</td>
<td>0.89 (0.68–1.17)</td>
</tr>
<tr>
<td>1989–1994</td>
<td>106</td>
<td>330</td>
<td>0.03 (0.03–0.04)</td>
<td>0.81 (0.62–1.06)</td>
</tr>
<tr>
<td>1995–2000</td>
<td>117</td>
<td>330</td>
<td>0.04 (0.03–0.04)</td>
<td>0.89 (0.69–1.16)</td>
</tr>
<tr>
<td>2001–2004</td>
<td>101</td>
<td>220</td>
<td>0.05 (0.04–0.06)</td>
<td>1.16 (0.88–1.52)</td>
</tr>
<tr>
<td>2005–2008</td>
<td>168</td>
<td>220</td>
<td>0.08 (0.07–0.09)</td>
<td>1.93 (1.51–2.45) p for trend &lt;0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>591</td>
<td>110</td>
<td>0.05 (0.05–0.06)</td>
<td>1.00</td>
</tr>
<tr>
<td>Female</td>
<td>287</td>
<td>110</td>
<td>0.03 (0.02–0.03)</td>
<td>0.41 (0.36–0.48) p value &lt; 0.001</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–54</td>
<td>117</td>
<td>160</td>
<td>0.01 (0.01–0.01)</td>
<td>0.12 (0.09–0.16)</td>
</tr>
<tr>
<td>55–59</td>
<td>78</td>
<td>130</td>
<td>0.06 (0.05–0.07)</td>
<td>1.00</td>
</tr>
<tr>
<td>60–64</td>
<td>112</td>
<td>130</td>
<td>0.08 (0.07–0.10)</td>
<td>1.43 (1.07–1.91)</td>
</tr>
<tr>
<td>65–69</td>
<td>139</td>
<td>100</td>
<td>0.14 (0.12–0.16)</td>
<td>2.37 (1.80–3.13)</td>
</tr>
<tr>
<td>70–74</td>
<td>156</td>
<td>870</td>
<td>0.18 (0.15–0.21)</td>
<td>3.08 (2.35–4.05)</td>
</tr>
<tr>
<td>75–79</td>
<td>133</td>
<td>720</td>
<td>0.18 (0.16–0.22)</td>
<td>3.24 (2.45–4.29)</td>
</tr>
<tr>
<td>80–84</td>
<td>99</td>
<td>530</td>
<td>0.19 (0.15–0.23)</td>
<td>3.40 (2.52–4.57)</td>
</tr>
<tr>
<td>85+</td>
<td>44</td>
<td>490</td>
<td>0.09 (0.07–0.12)</td>
<td>1.76 (1.21–2.55) p for trend &lt;0.001</td>
</tr>
</tbody>
</table>

All the mortality rate ratios are mutually adjusted for all other variables in the table.
Figure 2  Estimated number of deaths from Extrinsic Allergic Alveolitis, age standardised to the 2008 population of England and Wales.

Table 4  Standardised mortality rates and Poisson regression modelling of deaths from Sarcoidosis.

<table>
<thead>
<tr>
<th>Calendar period</th>
<th>Ndths</th>
<th>Person–years (million)</th>
<th>Mortality rate (standardised to 2008 pop per 100 000 (95% confidence interval))</th>
<th>Mutually adjusted rate ratios (95% confidence intervals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICD-8 1968–1972</td>
<td>328</td>
<td>270</td>
<td>0.12 (0.11–0.13)</td>
<td>1.00</td>
</tr>
<tr>
<td>1973–1978</td>
<td>418</td>
<td>330</td>
<td>0.13 (0.12–0.14)</td>
<td>1.06 (0.92–1.23)</td>
</tr>
<tr>
<td>1979–1983</td>
<td>360</td>
<td>270</td>
<td>0.13 (0.12–0.15)</td>
<td>1.10 (0.95–1.27)</td>
</tr>
<tr>
<td>ICD-9 1984–1988</td>
<td>447</td>
<td>270</td>
<td>0.16 (0.15–0.18)</td>
<td>1.36 (1.18–1.57)</td>
</tr>
<tr>
<td>1989–1994</td>
<td>540</td>
<td>330</td>
<td>0.17 (0.15–0.18)</td>
<td>1.37 (1.20–1.57)</td>
</tr>
<tr>
<td>1995–2000</td>
<td>539</td>
<td>330</td>
<td>0.17 (0.15–0.18)</td>
<td>1.37 (1.19–1.57)</td>
</tr>
<tr>
<td>ICD-10 2001–2004</td>
<td>433</td>
<td>220</td>
<td>0.20 (0.18–0.22)</td>
<td>1.65 (1.43–1.90)</td>
</tr>
<tr>
<td>2005–2008</td>
<td>479</td>
<td>220</td>
<td>0.22 (0.20–0.24)</td>
<td>1.83 (1.59–2.10)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1569</td>
<td>110</td>
<td>0.14 (0.14–0.15)</td>
<td>1.00</td>
</tr>
<tr>
<td>Female</td>
<td>1975</td>
<td>110</td>
<td>0.17 (0.17–0.18)</td>
<td>1.14 (1.07–1.22)</td>
</tr>
<tr>
<td>Age group (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–34</td>
<td>168</td>
<td>980</td>
<td>0.02 (0.02–0.02)</td>
<td>0.17 (0.13–0.21)</td>
</tr>
<tr>
<td>35–39</td>
<td>167</td>
<td>160</td>
<td>0.10 (0.09–0.12)</td>
<td>1.00</td>
</tr>
<tr>
<td>40–44</td>
<td>223</td>
<td>170</td>
<td>0.13 (0.11–0.15)</td>
<td>1.26 (1.03–1.54)</td>
</tr>
<tr>
<td>45–49</td>
<td>255</td>
<td>160</td>
<td>0.16 (0.14–0.18)</td>
<td>1.57 (1.29–1.91)</td>
</tr>
<tr>
<td>50–54</td>
<td>334</td>
<td>140</td>
<td>0.24 (0.22–0.27)</td>
<td>2.36 (1.96–2.84)</td>
</tr>
<tr>
<td>55–59</td>
<td>406</td>
<td>130</td>
<td>0.31 (0.28–0.34)</td>
<td>2.99 (2.50–3.58)</td>
</tr>
<tr>
<td>60–64</td>
<td>460</td>
<td>130</td>
<td>0.35 (0.32–0.38)</td>
<td>3.36 (2.81–4.01)</td>
</tr>
<tr>
<td>65–69</td>
<td>472</td>
<td>100</td>
<td>0.47 (0.43–0.52)</td>
<td>4.58 (3.84–5.46)</td>
</tr>
<tr>
<td>70–74</td>
<td>444</td>
<td>870</td>
<td>0.51 (0.47–0.56)</td>
<td>4.93 (4.13–5.89)</td>
</tr>
<tr>
<td>75–79</td>
<td>346</td>
<td>720</td>
<td>0.48 (0.43–0.53)</td>
<td>4.61 (3.83–5.55)</td>
</tr>
<tr>
<td>80–84</td>
<td>186</td>
<td>530</td>
<td>0.35 (0.30–0.40)</td>
<td>3.34 (2.71–4.12)</td>
</tr>
<tr>
<td>85 and above</td>
<td>83</td>
<td>490</td>
<td>0.17 (0.14–0.21)</td>
<td>1.59 (1.22–2.07)</td>
</tr>
</tbody>
</table>

All the mortality rate ratios are mutually adjusted for all other variables in the table.
Discussion

Using routinely available mortality data, we found that the mortality from Asbestosis has increased by ten-fold, mortality from Sarcoidosis has almost doubled whilst mortality from Extrinsic Allergic Alveolitis (EAA) has generally remained stable over a forty year period, in England and Wales. We found that death registrations were higher in men in Asbestosis and EAA, whilst in Sarcoidosis it was higher in women. We also found that mortality rates were higher in the older age groups for all three diseases. On the basis of our findings, we would expect 108 deaths from Asbestosis, 48 deaths from EAA and 132 deaths from Sarcoidosis each year in England and Wales.

The main strength of our study is the large number of registered deaths and the long period of time that this information was obtained over. This meant that we were able to stratify the results by age groups, sex and calendar period and provide precise estimates of mortality rates from each type of interstitial lung disease. Studies of this magnitude are extremely difficult to conduct in a clinical setting, due to the relatively small number of cases that present each year to secondary or tertiary referral centres.

The main potential weakness of our study is the validity of the diagnosis of Asbestosis, EAA and Sarcoidosis within our dataset. Because we have used routinely available mortality data, it is impossible to ascertain the diagnostic criteria used for diagnosing the respective types of interstitial lung disease. Although we have not formally validated the diagnoses of the above conditions in death certificate registration, we are reassured by a previous study which showed the diagnostic accuracy of death certification of cryptogenic fibrosing alveolitis (CFA) to be high. The same study showed that only 60% of individuals with CFA had the disease recorded in their death certificate. If you take this to apply to all types of interstitial lung disease, it is likely that our findings are an underestimation of the true mortality rates of these diseases. It is also our belief that it is unlikely for an individual to have a recording for interstitial lung disease on their death certificate without it being previously confirmed by secondary or tertiary care, especially in cases of Asbestosis, an occupational lung disease where patients are able to claim compensation.

Another potential weakness in our study is the possibility of coding errors as three different International Classification of Diseases (ICD) versions were used throughout the study period. This is a possible explanation for the steep decline in number of deaths coded as being from Asbestosis in 2007 and 2008. The mortality trend for Asbestosis from 1968 to 2006 showed a rapidly increasing number of deaths recorded each year, and it is unlikely for there to be such a sharp decline in number of deaths over such a short period of time. There were also numerous ICD codes used when collecting mortality data from Sarcoidosis. We used the ICD codes to indicate underlying cause of death from all manifestations of Sarcoidosis (see Table 1), which raises the possibility that our mortality rates are an overestimation of mortality from pulmonary sarcoid. However, previous research suggests that around 90% of cases with Sarcoidosis have pulmonary involvement, and it is the commonest cause of death among this patient group. Furthermore, the mortality rates for all three types of interstitial lung disease are likely to be a conservative estimate of the total number of deaths, as we have only collected data from death certificate registration on the underlying cause of death and not all causes of mortality recorded on a death certificate.

There is limited data on the trends in either incidence or mortality from Asbestosis, EAA and Sarcoidosis and our findings are similar to studies done previously. The Great Britain Asbestosis survey among British asbestos workers reported 477 deaths from Asbestosis from 1971 to 2005. However, this study was limited to workers with known Asbestosis exposure and is probably an underestimation of the actual mortality burden from Asbestosis. The rise in Asbestosis mortality in our study mirrors the trends in mortality from mesothelioma reported by Hodgson and colleagues, who predicted a continuous rise in deaths from mesothelioma that is expected to peak between 2011 and 2015. We would expect the same trend to apply with Asbestosis, as both Asbestosis and mesothelioma have a long latency periods between exposure and manifestation of symptoms.

We have previously found that incidence rates of EAA in primary care to be stable over a long period of time, with an overall rate of 0.9 per 100 000 person years. This complements our findings of a stable mortality rate throughout our study period. Our findings of a slight increase in mortality rates from Sarcoidosis is similar to trends found in a study conducted in the United States, which showed an annual increase of approximate 3% and higher mortality rates in women compared to men.

In summary, our findings suggest that Asbestosis, Extrinsic Allergic Alveolitis and Sarcoidosis are becoming important causes of respiratory mortality in the UK. However, the true burden of disease among this group of patients cannot be ascertained by mortality alone, as many patients remain stable but significantly disabled for long period of time. The significant morbidity associated with all three disease groups is important when deciding on allocation of health resources in the future and highlights the need for better evidence based treatment options for these conditions.

Conflict of interest

All authors on this manuscript declare no conflicts of interest.

Funding

VN is funded by a research grant from the Medical Research Council.

RH is funded by the GSK/BLF chair of Epidemiology Respiratory Research.

Acknowledgements

We would like to thank Joe West for providing the data used in the study.
References


