Asbestosis is prevalent in a variety of construction industry trades

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INTRODUCTION
Asbestosis is a diffuse interstitial fibrosis caused by inhalational exposure to asbestos after a latent period >20 years.¹ It is a diagnosis made through a history of exposure, exclusion of other causes and the characteristic computer tomography (CT) appearances of usual interstitial pneumonia; that is, bilateral subpleural reticulation in a basal distribution, with bronchial dilatation and honeycombing.² Current National Health Service (NHS) policy prevents prescription of antifibrotics for asbestosis³ though workers with confirmed asbestosis are eligible for state compensation.⁴ Thus, differentiating asbestosis from idiopathic pulmonary fibrosis (IPF) through exposure history is important but can be difficult, particularly because the dose of asbestos required to cause fibrosis is unknown.⁵ Heavy exposures as seen with asbestos miners, millers and textile workers has caused severe fibrosis with relatively short latency,⁶ but our current experience is one of asbestosis with comparatively lower exposures but longer latencies from work undertaken in the 1960–1970s, before the impact of UK regulations banning the import and use of asbestos.⁷ We aimed to identify the industries and occupations in patients diagnosed with asbestosis at a UK regional NHS occupational lung disease service to help clinicians identify those in whom a full exposure history is indicated.

RESULTS
Demographics
There were 160 cases of asbestosis diagnosed between 1 January 2001 and 31 December 2015 (2001–2005 (34), 2006–2010 (35), 2011–2015 (91); median = 10 cases per annum, interquartile range (IQR) = 5–13). Of 160 patients, 158 (99%) were males and median age at diagnosis was 74 (IQR = 69–79) with age distribution as follows: 51–60 years (3%), 61–70 years (33%), 71–80 years (43%) and 81–90 years (21%). At diagnosis 41 patients (26%) had asbestosis only, 117 (73%) had additional benign asbestos pleural disease (BAPD), 2 (1%) had mesothelioma (one with BAPD), and 2 (1%) had bronchial cancer (one with BAPD).

Industries and occupations
Commonly encountered industries and occupations are shown in Table 1. Construction was the commonest industry (44%) and most frequently identified across each 5-year period, becoming proportionally more common after 2005 (Fig. 1). Construction workers were most likely to be carpenters or joiners (12; 17%), laggers or lagger's mates (10; 14%), painters or decorators (7; 10%), shop fitters (7; 10%), roofers (5; 7%), labourers (5; 7%), pipe fitters or fitter's mates (4; 6%), plumbers (4; 6%), plasterers (4; 6%), floorers and tilers (4; 6%), sheet metal workers (2; 3%) or other (7; 10%). The two female patients were (1) a secretary from a British-based asbestos supply company and (2) a Portuguese civil servant now living in Britain, who worked in an asbestos mine near Chimoio in Mozambique between 1968 and 1972.

DISCUSSION
A variety of trades within the construction industry were commonly responsible for exposure sufficient to cause asbestosis: particularly carpenters and joiners, laggers, painters and shop fitters. Pipe fitters, labourers, steel workers and welders were also frequently implicated, seen in a number industries (including construction). Work in naval engineering, train carriage manufacture and in power stations were also regularly encountered, but other traditionally heavily exposed UK occupations such as shipbuilding were not seen commonly.

Asbestosis was first described in the UK in 1924 in a 33-year-old female asbestos factory worker.⁸ Although further health risks of asbestos subsequently emerged, UK asbestos consumption increased throughout the twentieth century.⁹ Its properties of low cost, strength, flexibility and resistance to chemical corrosion,
Table 1. Cases of asbestosis (2001–2016) at Birmingham Regional NHS Occupational Lung Disease Service, showing the frequencies of encountered industries (A) and occupations (B)

| Industry/Occupation                      | Number of cases (%) |
|-----------------------------------------|---------------------|
| Construction                            | 71 (44)             |
| Manufacturing                           | 21 (13)             |
| Defence                                 | 13 (8)              |
| Energy production                       | 12 (8)              |
| Automotive                              | 10 (6)              |
| Metals                                  | 6 (4)               |
| Shipping and shipbuilding               | 6 (4)               |
| Asbestos production and supply          | 4 (3)               |
| Demolition                              | 3 (2)               |
| Healthcare                              | 2 (1)               |
| Chemical                                | 2 (1)               |
| Education                               | 2 (1)               |
| Aerospace                               | 1 (<1)              |
| Civil service                           | 1 (<1)              |
| Prison service                          | 1 (<1)              |
| Confectionery                           | 1 (<1)              |
| Fishing                                 | 1 (<1)              |
| Parks and grounds                       | 1 (<1)              |
| Rail                                    | 1 (<1)              |
| Telecommunications                      | 1 (<1)              |
| Pipe fitter/pipe fitter’s mate [including fitter-welders] | 20 (13)             |
| Carpenter/joiner                       | 17 (11)             |
| Lagger/lagger’s mate                    | 16 (10)             |
| Building labourer                       | 9 (6)               |
| Painter/decorator [includes domestic and industrial] | 8 (5)               |
| Engineer [includes metal, civil, electrical, railway, naval] | 8 (5)               |
| Steel fabricator-welder/ steel erector/welder’s mate | 7 (4)               |
| Carriage fitter                         | 6 (4)               |
| Boiler man/stoker                       | 6 (4)               |
| Roofer                                  | 5 (3)               |
| Mechanic (includes rail, car, military) | 5 (3)               |
| Plumber                                 | 5 (3)               |
| Electrician                             | 5 (3)               |
| Sheet metal worker                      | 4 (3)               |
| Plasterer                               | 4 (3)               |
| Floorer/tiler                           | 4 (3)               |
| Driver (including trains and excavators) | 4 (3)               |
| Scientist/laboratory technician         | 3 (2)               |
| Assembler                               | 3 (2)               |
| Inspector                               | 2 (1)               |
| Manager                                 | 2 (1)               |
| Asbestos mixer                          | 2 (1)               |
| Shop fitter                             | 2 (1)               |
| Other [single entries]                  | 13 (8)              |

Manufacturing included production of train carriages (9 patients), cookers and ovens, refrigerators, plastics, shoes, tyres, ironing boards, electrical items and table sauce; the nine patients from train carriage manufacturing were from a single employer and were: carriage fitters (6), carpenter (1), painter (1) and sheet metal worker (1). Those employed by the Ministry of Defence (defence industry) were naval shipwrights/fitters and electricians (10), articifer (1), railway mechanic (1) and metal worker (1). Of 12 patients, 9 employed in the energy industry worked in power stations as fitter-welders (5), lagger or lagger’s mates (3) and a steel erector (1).

Fig. 1 Common industries implicated in causation of asbestosis 2001–2016 at Birmingham Regional NHS Occupational Lung Disease Service. Construction was consistently the most frequently encountered industry during each 5-year period, becoming proportionally more common in 2006–2010 (p = 0.02) and 2011–2016 (p = 0.15) when compared to 2001–2005.
about whether a proportion of IPF is actually asbestosis, caused by ‘hidden’ or low-dose asbestos exposures.\textsuperscript{17}

Asbestosis is an important diagnosis to suspect since the natural history may be different to IPF; there is an increased risk of mesothelioma when asbestos exposure has been recognized, and workers are eligible for state compensation. It is worthwhile considering asbestosis and referral for a full occupational history in patients who have worked in construction trades, presenting with chronic respiratory symptoms.

**METHODS**

All cases of asbestosis diagnosed at the regional NHS Occupational Lung Disease Service in Birmingham, UK between 1 January 2001 and 31 December 2016 have been retained on a Microsoft Excel clinical database containing pseudo-anonymized data (by reference to hospital identification number only). These local data are used for monthly notifications to the UK Health and Safety Executive (HSE) national “Surveillance of Work-related Respiratory Disease (SWORD)” voluntary surveillance scheme for occupational lung disease.\textsuperscript{18} Diagnosis of asbestosis is based on exposure history and expert opinion on whether dose is sufficient to cause asbestosis, CT appearance and exclusion of other causes of usual interstitial pneumonia. From the database the following data were gathered, without recourse to individual patients’ medical records: age at diagnosis, gender, presence of additional asbestos-related diseases at diagnosis of asbestosis, and industry and occupation where exposure occurred. Descriptive analyses were performed; non-normally distributed data were displayed using median and IQR, and categorical data with percentages. Chi-squared testing at the 95% confidence level was used to look for significant differences between categories. The study was considered to be a service evaluation by UK Health Research Authority and Heart of England NHS Foundation Trust, and as such no ethical approval was sought.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

**AUTHOR CONTRIBUTIONS**

G.I.W. undertook study design and data analysis. G.I.W., A.S.R., P.S. Bhomra and P.S. Burge wrote and edited the paper.

**ADDITIONAL INFORMATION**

**Competing interests:** The authors declare no competing interests.

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