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Occupation and work-related ill-health in UK construction workers

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Background	Construction workers are at increased risk of work-related ill-health (WRI) worldwide.
Aims	To compare the incidence of medically reported WRI in occupations within the UK construction industry according to job title.
Methods	We calculated standardized incidence rate ratios (SRRs) using WRI cases for individual job titles returned to The Health and Occupation Reporting network by clinical specialists and UK population denominators. We counted frequencies of reported causal exposures or tasks reported by clinical specialists, occupational physicians and general practitioners.
Results	We found significantly increased incidence of WRI compared with other workers in the same major Standard Occupational Classification, i.e. workers with similar levels of qualifications, training, skills and experience, for skin neoplasia in roofers (SRR 6.3; 95% CI: 3.1–13.1), painters and decorators (2.1; 95% CI: 1.2–3.6) and labourers in building and woodworking trades (labourers, 6.6; 95% CI: 3.2–13.2); contact dermatitis in metal workers (1.4; 95% CI: 1.1–1.7) and labourers (1.6; 95% CI: 1.1–2.3); asthma in welders (3.8; 95% CI: 2.8–5.0); musculoskeletal disorders in welders (1.7; 95% CI: 1.1–2.8), road construction operatives (6.1; 95% CI: 3.8–9.6) and labourers (2.5; 95% CI: 1.7–3.7); long latency respiratory disease (mesothelioma, pneumoconiosis, lung cancer, non-malignant pleural disease) in pipe fitters (4.5; 95% CI: 3.2–6.2), electrical workers (2.7; 95% CI: 2.4–3.2), plumbing and heating engineers (2.3; 95% CI: 1.9–2.7), carpenters and joiners (2.7; 95% CI: 2.3–3.1), scaffolders (12; 95% CI: 8–18) and labourers (3.3; 95% CI: 2.6–4.1).
Conclusions	UK construction industry workers have significantly increased risk of WRI. These data in individual construction occupations can be used to inform appropriate targeting of occupational health resources.
Key words	Construction industry; incidence; occupational exposure; occupational health.

Introduction

Construction workers are at increased risk of work-related ill-health (WRI) and injury globally and in Europe [1]. For example, male German construction workers have increased incidence of cancer, respiratory disease, musculoskeletal disorders (MSD) and injuries compared with the general population and for MSD and injuries compared with blue-collar workers [2]. Male UK construction workers have increased incidence of skin neoplasia, contact dermatitis (CD), MSD, mesothelioma, lung cancer, pneumoconiosis and other benign pleural disease compared with the rest of the working population [3].

UK construction workers have poor access to occupational health services (~7% in 2001 [4]) and high rates of disability [5]. The UK has the highest proportion of self-employed construction workers in Europe (~30% in 2000) although many of these are actually employed but are classed as self-employed for tax purposes [6]. Furthermore, the industry employs a high proportion of migrant workers (~8% of responders to a survey in 2005/2006 [7]).

The Health and Occupation Reporting (THOR) network is a voluntary surveillance scheme for reporting cases of medically diagnosed occupational disease and WRI [8] that has been used previously to describe the overall incidence of WRI in the UK construction

industry [3]. Here, the same dataset is used to provide a more detailed breakdown of WRI within construction workers according to individual job titles. A secondary aim is to compare the frequencies of reports of tasks and exposures in skilled tradesmen causing or contributing to WRI from different types of physician [clinical specialist, occupational physician (OP) or general practitioner (GPs)].

Methods

UK clinical specialists (dermatologists, rheumatologists, respiratory physicians and psychiatrists), OPs and GPs return reports of WRI, which is ill-health that, in the opinion of the physician, has been caused, or made worse by work, during a reporting month [8,9]. All GPs reporting to THOR have basic training in occupational health [10]. Some physicians report every month (core reports) and others report for a randomly assigned month each year (sample reporters). The 'sample reports' are multiplied by 12 in order to estimate the annual number of cases, hereafter referred to as 'estimated cases'. All UK workers should have access to GP and clinical specialist physicians but access to occupational health services is poor among construction workers [4].

THOR occupational data are coded using the UK Standard Occupational Classification 2000 (SOC) and UK Standard Industrial Code 2003 (SIC). There are 353 'unit groups'—the finest level of occupational classification—in the SOC; these can be categorized into 25 broad 'sub-major' groups or 9 even broader major groups. Sub-sets of THOR data for 2002–2008 representing the sub-major groups skilled construction and building trades (SOC = 53, ~7% of the UK male working population, 11) and skilled metal and electrical trades (SOC = 52, ~8% of the UK male working population, 11), and several unit occupational groups frequently found in the construction industry (Table 1) were selected for analysis. Unit groups with the descriptor 'not elsewhere classified' (n.e.c.) are provided in SOC for job titles that do not fit in more precisely described unit groups. Data from the UK Labour Force Survey 2005 (LFS), also classified by SOC codes, were used as denominator data (see below) for the clinical specialist reported cases. Incidence rate ratios (RRs) were not calculated using OP or GP reports because the coverage and/or the sampling characteristics of these schemes mean that LFS denominators may be inappropriate but the frequencies of actual reports of causal exposures or MSD diagnoses are presented.

The method for calculating standardized incidence rate ratios (SRRs) for workers aged 65 years or under and RRs for workers aged 65 years or over using reports of WRI from clinical specialists as the numerator and the LFS 2005 data [11] as the denominator and as the population for direct standardization has been described previously [3,12]. The reports were analysed separately for workers aged over 65 years (RRs) and under 65 years (SRRs). This is because many reports of long latency disease to THOR originate from retired workers but the corresponding denominator (LFS) includes the working population only, i.e. does not include retired people. Therefore in order to calculate the RR, it must be assumed that the ratio of retired to working people is similar in construction workers to all other workers. This has been discussed in more detail previously [3,12]. This caveat does not apply when calculating the SRRs; therefore, SRRs and RRs are presented separately. In calculating the confidence intervals (CIs) for the SRRs and RRs, consideration was given to the increased contribution of the sample reports to the variance and to the reduction in variance due to the high proportion of eligible physicians reporting to THOR (by means of a finite population correction [3,12]).

SRRs and RRs were only calculated for occupational groups with at least five actual reports by clinical specialists to THOR. Two denominators were used: all UK workers and workers within the same major SOC group [13]. Reports with missing age and/or gender data represented a small proportion of the data (MSD 4.5%, mental ill-health 1.5%, respiratory disease 0.9% and skin disease 0.3%) and were not included in calculating SRRs and RRs.

Multicentre Research Ethics Committee approval (02/8/72) has been given for THOR.

Results

Only 1% of reports to THOR within these trades were females, so results are shown for males only. Between 2002 and 2008, >1400 clinical specialists returned 18 509 actual case reports to THOR, 1850 (10%) in construction and building trades and 2514 (14%) in metal and electrical trades. Over 400 OPs returned 11 109 actual case reports, 166 (1%) in construction and building trades and 612 (6%) in metal and electrical trades. During 2006–2008, >300 GPs returned 4008 core reports, 316 (8%) in construction and building trades and 239 (6%) in metal and electrical trades. Most reports by clinical specialists originating from construction and building tradesmen (SOC 53) were of men employed within the construction industry (SIC = 45, 1506/1850, 81%), whereas metal and electrical tradesmen (SOC 52) were widely distributed across most UK industries, most commonly the motor vehicle repair industry (SIC = 50, 623/2514, 25%), followed by the construction industry (SIC = 45, 346/2514, 14%).

SRRs (aged ≤ 65 years) according to occupation and broad disease category as reported by clinical specialists are shown in Table 1 and RRs (aged > 65 years) in

Table 1. Directly standardized incidence rate ratios (SRR) of reports of WRI made to THOR Network by dermatologists, respiratory physicians and rheumatologists for skilled tradesmen and construction-related occupations in the UK from 2002 to 2008

SOC 2000	Job description	SRR CDs (95% CI)			SRR asthma (95% CI)			SRR long latency respiratory disease[a] (95% CI)			SRR skin neoplasia (95% CI)			SRR MSDs (95% CI)		
		Estimated male cases	Denominator		Estimated male cases	Denominator		Estimated male cases	Denominator		Estimated male cases	Denominator		Estimated male cases	Denominator	
			All workers	Major SOC group		All workers	Major SOC group		All workers	Major SOC group		All workers	Major SOC group		All workers	Major SOC group
1122	Managers in construction	5		0.5 (0.3–1.0)	0	–[b]	–	37	0.4 (0.2–0.7)	**7.2 (3.3–15.8)**	2	–	–	1	–	–
3122	Draftspersons	1	–	–	0	–	–	13	0.1 (0.05–0.3)	**3.5 (1.2–9.7)**		–	–	2	–	–
5215	Welding trades	62	**2.5 (1.5–4.0)**	1.1 (0.7–1.7)	62	**4.7 (3.9–5.7)**	**3.8 (2.8–5.0)**	46	**1.8 (1.2–2.8)**	0.7 (0.4–1.0)	2	–	–	119	**3.5 (2.1–5.5)**	**1.7 (1.1–2.8)**
5216	Pipe fitters	0	–	–	1	–	–	72	**12 (9–17)**	**4.5 (3.2–6.2)**	1	–	–	14	–	–
5223	Metalworking production and maintenance fitter	283	**3.2 (2.6–3.9)**	**1.4 (1.1–1.7)**	51	**2.0 (1.3–2.9)**	0.9 (0.6–1.4)	359	**3.9 (3.2–4.5)**	**1.4 (1.2–1.6)**	1	–	–	258	**2.4 (1.7–3.3)**	1.2 (0.8–1.6)
5241	Electricians and electrical fitters	95	1.1 (0.8–1.6)	0.5 (0.3–0.7)	4	0.2 (0.1–0.3)	0.07 (0.04–0.10)	530	**7.4 (6.4–8.5)**	**2.7 (2.4–3.2)**	0	–	–	175	**1.8 (1.2–2.7)**	0.9 (0.6–1.2)
Total[c] 52	Skilled metal and electrical trades	941	**2.4 (2.1–2.7)**	0.9 (0.8–1.0)	375	**3.2 (2.8–3.8)**	**1.5 (1.2–1.9)**	1262	**3.7 (3.3–4.1)**	1.2 (1.0–1.3)	34	0.4 (0.2–0.7)	0.1 (0.06–0.2)	1058	**2.3 (1.9–2.7)**	1.0 (0.8–1.3)
5312	Bricklayers and masons	102	**2.6 (1.8–3.6)**	**1.1 (0.8–1.6)**	0	–	–	91	**2.6 (1.8–3.8)**	0.9 (0.6–1.3)	17	**2.7 (1.1–6.5)**	1.2 (0.5–2.8)	74	1.7 (0.9–2.9)	0.8 (0.4–1.4)
5313	Roofers, roof tilers and slaters	26	1.5 (0.9–2.6)	0.7 (0.4–1.1)	0	–	–	33	**3.4 (2.8–4.2)**	1.2 (1.0–1.5)	29	**14 (7–29)**	**6.3 (3.1–13.1)**	29	1.5 (0.6–3.7)	0.8 (0.3–1.8)
5314	Plumbing, heating and ventilating engineers	99	**1.7 (1.1–2.4)**	0.7 (0.5–1.0)	2	–	–	391	**6.3 (5.3–7.4)**	**2.3 (1.9–2.7)**	0	–	–	162	**2.3 (1.6–3.5)**	1.1 (0.7–1.8)
5315	Carpenters and joiners	135	1.3 (1.0–1.8)	0.6 (0.4–0.8)	24	0.4 (0.3–0.6)	0.2 (0.1–0.3)	576	**7.3 (6.3–8.4)**	**2.7 (2.3–3.1)**	32	1.8 (0.9–3.5)	0.8 (0.4–1.5)	242	**2.1 (1.5–3.0)**	1.0 (0.7–1.5)
5319	Construction trades n.e.c.	206	**3.2 (2.4–4.2)**	**1.4 (1.1–1.8)**	1	–	–	266	**3.0 (2.4–3.7)**	1.0 (0.8–1.3)	181	**12 (9–16)**	**6.3 (4.5–8.8)**	218	**2.4 (1.7–3.5)**	1.2 (0.8–1.8)
5321	Plasterers	10	0.6 (0.4–0.9)	0.3 (0.2–0.4)	1	–	–	16	1.1 (0.5–2.5)	0.4 (0.1–0.9)	1	0.4 (0.1–1.3)	0.2 (0.05–0.6)	32	1.4 (0.7–3.1)	0.9 (0.4–1.8)

Table 1. (*Continued*)

SOC 2000	Job description	SRR CDs (95% CI)			SRR asthma (95% CI)			SRR long latency respiratory disease[a] (95% CI)			SRR skin neoplasia (95% CI)			SRR MSDs (95% CI)		
		Estimated male cases	Denominator		Estimated male cases	Denominator		Estimated male cases	Denominator		Estimated male cases	Denominator		Estimated male cases	Denominator	
			All workers	Major SOC group		All workers	Major SOC group		All workers	Major SOC group		All workers	Major SOC group		All workers	Major SOC group
5323	Painters and decorators	103	**2.0 (1.4–2.7)**	0.8 (0.6–1.2)	31	**1.9 (1.1–3.5)**	0.9 (0.5–1.6)	132	**2.2 (1.6–2.8)**	0.7 (0.5–1.0)	56	**4.8 (2.9–8.0)**	**2.1 (1.2–3.6)**	126	**2.0 (1.2–3.2)**	1.0 (0.6–1.6)
8141	Scaffolders, stagers and riggers	2	–	–	0	–	–	83	**12 (8–17)**	**12 (8–18)**	0	–	–	24	–	–
8142	Road construction operatives	18	2.0 (0.9–4.5)	1.0 (0.4–2.1)	0	–	–	12	–	–	2	–	–	140	**11 (7–17)**	**6.1 (3.8–9.6)**
8149	Construction operatives n.e.c.	18	0.6 (0.3–1.4)	0.3 (0.1–0.6)	1	–	–	174	**7.3 (5.7–9.3)**	**8.3 (6.3–11.0)**	14	–	–	56	**2.0 (1.1–3.8)**	1.0 (0.5–1.8)
9121	Labourers build and woodworking trades	103	**1.7 (1.2–2.5)**	**1.6 (1.1–2.3)**	24	–	–	272	**5.0 (4.0–6.2)**	**3.3 (2.6–4.1)**	49	**4.1 (2.2–7.3)**	**6.6 (3.2–13.2)**	253	**4.0 (2.8–5.7)**	**2.5 (1.7–3.7)**
9129	Labourers other construction trades n.e.c.	6	0.6 (0.3–0.9)	0.4 (0.2–0.7)	2	–	–	315	**33 (27–39)**	**25 (20–31)**	3	–	–	7	**6.5 (3.6–11.5)**	**4.7 (2.7–8.3)**
Total[c] 53	Skilled construction and building trades	779	**2.1 (1.8–2.4)**	0.8 (0.7–0.9)	61	0.2 (0.1–0.3)	0.1 (0.08–0.2)	1550	**5.2 (4.7–5.7)**	**1.9 (1.6–2.1)**	318	**5.4 (4.2–6.8)**	**3.2 (2.3–4.5)**	993	**2.3 (1.9–2.7)**	1.0 (0.8–1.3)

Bold values indicate that SRR or RR is significantly raised, $P < 0.05$.

[a]Long latency respiratory disease = pneumoconniosis, mesothelioma, lung cancer, non-malignant pleural disease.

[b]Insufficient cases to estimate SRR.

[c]Total = sub-major SOC group.

Table S1. SRRs and RRs are shown with two different denominators—the rate for all other occupations combined ('all workers' in Tables 1, S1 and S2; Tables S1 and S2 are available as Supplementary Data at *Occupational Medicine* Online) and the rate for all other occupations combined in the same major SOC group ('major SOC group' in Tables 1, S1 and S2). Using the rate ratios with all workers as the denominator allows direct comparisons between occupations
e.g. draftsmen with plasterers. Using the rate ratios with 'major SOC group' as the denominator allows comparisons with workers of similar levels of qualifications, training, skills and experience. For example, the incidence of MSD or CD (Table 1) is significantly raised in skilled tradesmen (SOC 52 and SOC 53) compared with all workers but there is little difference in incidence between the specific trades or other occupations in SOC Group 5 which also includes agricultural workers, textile workers, chefs and butchers.

Significantly raised SRRs for long latency respiratory disease (mesothelioma, pneumoconiosis, lung cancer and non-malignant pleural disease), using either denominator, are observed in pipe fitters, electrical workers, plumbing and heating engineers, carpenters and joiners, scaffolders and labourers in building and woodworking trades (Table 1). For skin neoplasia, SRRs are significantly raised with either denominator in roofers, painters and decorators and labourers in building and woodworking trades. For CD, the SRRs are significantly increased in most occupations when using all other workers as the denominator, but not with the major SOC group denominator. However, for asthma, only welders have significantly raised SRRs using either denominator. MSDs are significantly raised in welders, road construction operatives and labourers in building and woodworking trades. There are also increased SRRs for labourers n.e.c. and construction operatives n.e.c., in all disease categories, but these increases may be due to misclassification. SRRs for mental ill-health in construction and building tradesmen were 0.2 (95% CI: 0.1–0.3) and 0.4 (95% CI: 0.3–0.5) for metal and electrical tradesmen, respectively, but too few cases were reported to estimate SRRs by individual job titles.

The SRRs and RRs shown in Tables 1 and S1 are split into more specific respiratory and skin diagnoses for skilled tradesmen in Table S2. Irritant CD was more common among metal and electrical tradesmen, whereas allergic CD was more common among building and construction tradesmen. The SRRs were significantly raised for all types of skin neoplasia in construction and building tradesmen, but not metal and electrical tradesmen, and for all types of long latency respiratory disease in skilled tradesmen.

The suspected causal agents for CD in skilled tradesmen as reported by dermatologists, OPs and GPs are shown in Table 2. The most common cause of allergic CD in building and construction tradesmen reported by dermatologists was chromate compounds, frequently associated with exposure to cement causing irritant CD. OPs and GPs reported higher proportions of CD due to cement, plaster and masonry rather than specific agents, such as chromate compounds, perhaps reflecting access to patch testing. The most commonly reported exposures causing irritant CD in metal and electrical tradesmen were oils, greases or metalworking fluids, particularly by GPs. This often occurred with allergic CD due to preservatives in oils or metalworking fluids.

Suspected causal agents reported by respiratory physicians and OPs for asthma in skilled tradesmen are shown in Table 3. The commonest causal exposures in metal and electrical tradesmen were to isocyanates (from paint spraying) and to metalworking fluids. For building and construction tradesmen, these were wood and wood dust. There were no reports of asthma in building and construction tradesmen by OPs. Most long latency respiratory disease in skilled tradesmen was attributed to asbestos exposure (2410/2460, 98%), then pneumoconiosis attributed to silica (25/2460, 1%). Almost all neoplasia in skilled tradesmen were attributed to sunlight or ultraviolet light (UVL) exposure. Table S3 (available as Supplementary Data at *Occupational Medicine* Online) shows diagnoses and precipitating tasks and movements causing MSD in skilled tradesmen reported by rheumatologists, OPs and GPs. OPs and rheumatologists reported more hand–arm MSD due to guiding or holding a tool, whereas GPs reported more back, hip and knee problems due to lifting and carrying.

Discussion

This study found that labourers in building and construction trades had significantly increased incidence of WRI (respiratory, skin and MSD) compared with the UK working population or the corresponding major SOC group (SOC 9, elementary occupations).

The data analysed allow comparisons of the incidence and type of medically diagnosed WRI according to job titles, causal tasks and exposures in UK construction workers.

Previously, these data have been analysed at industry level [3]. The all workers denominator allows direct comparisons between occupations regardless of major SOC group, whereas the major SOC group denominator reduces confounding due to non-work-related factors, such as socio-economic group and social class [13]. However, the latter can obscure causes or exposures common to the major SOC group, hence the value of the former. Some occupational groups with significantly increased SRRs using the all workers denominator did not have significantly raised SRRs using the major SOC group denominator,

Table 2. The distribution of suspected causal agents for CD in skilled tradesmen reported to THOR Network by dermatologists and OPs from 2002 to 2008 and by GPs from 2006 to 2008

Suspected causal agents for CD (males only)[a]	Most common causal mechanism	Skilled metal and electrical trades (SOC = 52)			Skilled construction and building trades (SOC = 53)		
		Dermatologists, n = 457, agents = 784, n (%)	OPs, n = 78, agents = 81, n (%)	GPs, n = 28, agents = 41, n (%)	Dermatologists, n = 321, agents = 557, n (%)	OPs, n = 12, agents = 15, n (%)	GPs, n = 16, agents = 19, n (%)
Chrome and its compounds	Allergic	33 (4)	2 (2)	0	108 (19)	0	0
Cobalt and its compounds	Both	23 (3)	2 (2)	0	37 (7)	0	0
Nickel and its compounds	Allergic	26 (3)	3 (4)	0	17 (3)	0	0
Other metals	Irritant	9 (1)	1 (1)	0	5 (1)	0	0
Cement plaster masonry	Both	4 (1)	1 (1)	0	48 (9)	5 (33)	9 (47)
Wood and wood dust	Both	2 (<1)	0	0	23 (4)	0	1 (5)
Epoxy/acrylic resins and hardeners	Allergic	44 (6)	12 (15)	2 (5)	63 (11)	2 (13)	
Colophony or flux	Irritant	2 (<1)	1 (1)	0	18 (3)	0	1 (5)
Glues/adhesives	Allergic	8 (1)	1 (1)	0	13 (2)	1 (7)	0
Aldehydes	Allergic	19 (2)	1 (1)	0	4 (1)	0	0
Metalworking fluid	Irritant	31 (4)	8 (10)	1 (2)	2 (<1)	0	0
Oils/greases	Irritant	140 (18)	10 (12)	20 (49)	9 (2)	0	0
Solvents	Irritant	40 (5)	8 (10)	4 (10)	18 (3)	1 (7)	2 (11)
Paints	Allergic	9 (1)	1 (1)	1 (2)	12 (2)	1 (7)	0
Preservatives/ anti-bacterials	Allergic	72 (9)	1 (1)	0	20 (4)	0	2 (11)
Hand washing/ soaps/detergents	Irritant	51 (7)	4 (5)	9 (22)	22 (4)	1 (7)	2 (11)
Dirty water	Irritant	22 (3)	0	0	21 (4)	0	0
Friction/dirt/grit/ mechanical	Irritant	34 (4)	2 (2)	0	10 (2)	0	0
Dust or fumes	Irritant	4 (1)	2 (2)	0	10 (2)	1 (7)	0
Gloves/rubber unspecified	Allergic	85 (11)	2 (2)	3 (7)	47 (8)	1 (7)	1 (5)
Others	Both	126 (16)	19 (23)	1 (2)	50 (9)	2 (13)	1 (5)

[a]All reports are actual cases, i.e. not estimated.

reflecting increased risk distributed evenly throughout the major SOC group. A similar observation has been made using different denominators to calculate SRRs for early retirement and mortality in German construction workers [2].

Occupations at increased risk of long latency respiratory disease (Table 1) resemble those at high risk of mesothelioma in a recent British population-based study [14] and in French and Swedish workers exposed to asbestos [15,16]. Dutch construction workers exposed to quartz had increased risk of pneumoconiosis [17], but most pneumoconiosis reports to THOR were attributed to asbestos (85%), then silica (11%).

The increased asthma incidence in welders is consistent with a registry-based Finnish study; but only 2% of the Finnish cases were designated as work related [18]. The low incidence of asthma in construction and building tradesmen may reflect respiratory physicians' strict criteria for attributing asthma to work. Occupational asthma incidence estimates from surveillance data are often lower than expected from community-based cross-sectional studies of asthma patients [19,20].

The increased SRR for cutaneous melanoma in skilled construction and building tradesmen (Table S2) is based on a small number of reports with potential

Table 3. Distribution of suspected causal agents for asthma in skilled tradesmen reported to THOR Network by respiratory specialists and OPs from 2002 to 2008.

Suspected causal agents for asthma[a]	Skilled metal and electrical tradesmen (SOC = 52)		Skilled construction and building tradesmen (SOC = 53)[b]
	Chest physicians, n = 230, agents = 240, n (%)	OPs, n = 24, agents = 32, n (%)	Chest physicians, n = 26, agents = 26, n (%)
Metalworking fluids/coolants	59 (25)	1 (3)	0
Cobalt	8 (3)	0	0
Zinc	12 (5)	1 (3)	0
Chrome and its compounds	22 (9)	0	0
Other metals	11 (5)	0	0
Welding fumes	24 (10)	2 (6)	1 (4)
Wood and wood dust	0	0	11 (42)
Oils/greases	1 (<1)	3 (9)	1 (4)
Solvents/fuel oil	5 (2)	7 (22)	0
Paints and dyes	9 (4)	3 (9)	5 (19)
Isocyanates	60 (25)	13 (41)	4 (15)
Formaldehyde	3 (1)	0	0
Other fumes and gases	7 (3)	0	0
Others	19 (8)	2 (6)	4 (15)

[a]All reports are actual cases, i.e. not estimated.

[b]No reports by OPs for SOC 53.

misclassification between labourers and skilled tradesmen. Proportional registration ratios for cutaneous melanoma in England and Wales are significantly raised for labourers n.e.c. but not construction workers [21]. The increased SRR for non-melanoma skin cancer (NMSC) agrees with high estimated numbers of work-related NMSC registrations in UK construction workers, particularly roofers [22]. Furthermore, NMSC registrations in Italy, France and Spain were associated with labouring as with these data [23]. However, no increased risk of NMSC was found in Swedish construction workers [24] or melanoma registration ratios [21]. These UK data resemble Southern European rather than Scandinavian data, suggesting that factors other than latitude are important.

Increased SRRs for MSD in skilled tradesmen and unskilled construction workers (Table 1) are consistent with self-reported MSD in the LFS, particularly upper body MSD, in UK construction and building trades [25].

In estimating rate ratios, the determining relationships are the ratio of disease incidence and the ratio of the denominators. For short latency disease, the group at risk is the current working population and therefore, the LFS population estimates are appropriate. However, for long latency disease the SRRs may be affected by several factors. The ratio of disease incidence is affected by different lag periods for diseases in different occupations. Although lag periods for specific diseases might be expected to be similar, intensity and duration of exposure are important. Larger effects on SRRs could originate from the denominator ratio, as the historically exposed population may be quite different to the current LFS estimates. Denominator ratios are affected by the factors causing a healthy worker survivor effect, i.e. attrition rates due to mortality, disability, retirement or differences in occupational mobility [26]. If these events are more likely in the occupational group considered, RRs may be overestimated. A healthy worker survival effect was seen in a cohort of German construction workers [27] and ill health retirement in Irish construction workers [28]. If the labour turnover in construction workers here were higher than in all other occupations, RR would be increased relative to the SRR, as observed for lung cancer in metal and electrical tradesmen (Table S2). Interestingly, the opposite trend (SRR > RR) is seen for skin neoplasia in construction and building tradesmen. NMSC is mostly due to cumulative exposure to sunlight and construction workers could be exposed to sunlight at a younger age.

It is possible that use of n.e.c. occupational classification was used more frequently in coding THOR data than in the LFS data, due to insufficient information from the reporting physician. CIs do not take account of errors in the LFS population estimates or the possibility that the THOR reporters are not representative of all eligible physicians. Another potential source of bias is that knowledge of occupation may influence reporters' attribution of causal agent and work relatedness. For example, the raised incidence of skin neoplasia in construction and building tradesmen might reflect physicians' assumptions

rather than an assessment of sunlight exposure. This could account for the reduced incidence in metal and electrical tradesmen where physicians might assume less sunlight exposure. However, the RR for welders aged over 65 years is significantly increased, implicating differences in exposure (short, intense UVL) or use of personal protective equipment rather than misclassification by reporting physicians.

Chromates increase occupational risk of CD and also indicate common exposure to a carcinogen. Following the Chromium (VI) Directive (2003/53/EC), manufacturers and suppliers in the UK were required to reduce the levels of chromates in cement. Similar legislation in Denmark and Germany preceded a significant reduction in allergic CD due to chromate [29,30]. Analysis of THOR data could explore such a trend in the UK.

These UK WRI incidence data in construction workers are consistent with German, French, Italian, Spanish, Swedish and other UK data, except for skin neoplasia which is not raised in Swedish construction workers. UK labourers in building and woodworking trades are at particular risk of WRI. At the time of data collection, access to OPs was poor in the construction industry [4], so reporting by clinical specialists is especially useful in this sector. Access to OPs for construction workers may improve following high-profile construction projects such as the 2012 Olympics or Crossrail project. These data provide a baseline from which to monitor occupation-specific changes in incidence and effectiveness of interventions and facilitate targeting interventions for those at highest risk.

Key points

- Labourers in building and construction trades have significantly increased incidence of work-related ill-health (respiratory, skin and musculoskeletal disorder) compared with the UK working population or the corresponding major Standard Occupational Classification group (SOC 9; elementary occupations).
- There are few reports of work-related asthma in UK construction workers, except for welders where the incidence is significantly increased compared with the UK working population or other skilled metal and electrical tradesmen.
- These data can help to inform decisions on prioritizing resources for prevention and management of work-related ill-health in UK construction workers.

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Conflicts of interest

None declared.

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