occupations with an *a priori* risk of COPD and chronic respiratory symptoms, remained after adjustment for age and smoking status, using pack year history. The strength of the relationship between symptoms and work varied by occupational type; cleaners, painters and agricultural workers had the highest risk of breathlessness when compared to the referent population (Abstract S2 table 1). An increased risk of doctor-diagnosed COPD (COPD, chronic bronchitis or emphysema) was also found in cleaners, transport workers, wood and construction workers (data not shown); in comparison with the prevalence of respiratory symptoms, the number of men declaring doctor-diagnosed disease was small (21% vs 5%). This study demonstrates an association between occupational exposure, chronic respiratory symptoms and doctor-diagnosed COPD within a general population of older males in the UK independent of smoking history. Further characterisation of the cohort, using the results of spirometry, will allow the relationship between risky job exposure and disease to be examined in more detail.

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S3 WORK PERFORMANCE AND AIRFLOW OBSTRUCTION IN A GENERAL UK POPULATION OF OLDER WORKERS

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Work disability as a consequence of COPD has been found in a number of patient cohorts and respiratory symptoms were shown to be significantly associated with work limitation in the Lungs at Work study.[1] The impact of airflow obstruction on impaired work performance in the general population is unknown. The clinical assessment was designed to examine the relationship between respiratory symptoms and work performance in a general population of older workers in more detail. Volunteers in full time employment at the time of the initial postal questionnaire study (of 51 to 60-year olds through general practice) underwent clinical assessment, including spirometry (n=1773). Results are shown in Abstract S3 table 1. Prevalence of declared doctor-diagnosed COPD was low (1.9% of men and 0.6% of women) compared to that of airflow obstruction on spirometry (post-bronchodilator FEV_1<80% predicted and FEV_1/FVC ratio<0.7) was higher, similar to previous published estimates. Men and women with airflow obstruction had a significantly higher prevalence of poor self-reported performance at work than individuals with normal spirometry. Subjects of both sexes with abnormal spirometry who also reported high levels of physical activity in their current job were significantly more likely to report poor work performance than individuals without airflow obstruction with similarly high activity levels; this difference was not seen in low activity work (data not shown). Men were significantly more likely than women to predict that they would stop work due to ill-health. In both sexes, participants with abnormal spirometry were significantly more likely to predict ill-health retirement than individuals with normal lung function. This study has demonstrated an association between airflow obstruction and both work performance within a general population of older workers; the level of physical activity required at work had an important effect on this relationship. Future loss from the workforce due to ill-health was also related to lung function. Detection of airflow obstruction could aid retention in employment, provided that suitable interventional strategies are in place to support older workers.

Abstract S3 Table 1 Self-reported work performance, physical activity and current work exposures in a general population of adults aged 51–60 in full time employment (n=1773), stratified by sex and airflow obstruction

	Men (n=1101) n, %	Women (n=672) n, %	p Value
Poor work performance	112 (10.4)	54 (8.2)	0.128
High level of physical activity at work	496 (46.1)	227 (34.6)	<0.001
Airflow obstruction*	77 (7.3)	25 (3.9)	0.004
Health will limit ability to work	568 (52.1)	271 (40.7)	<0.001

	Airflow obstruction* n, %			Airflow obstruction* n, %		
	Yes (n=77)	No (n=977)	p Value	Yes (n=25)	No (n=617)	p Value
Poor work performance	13 (16.9)	90 (9.4)	0.035	5 (20.0)	48 (7.9)	0.032
Poor work performance and high level of physical activity at work	11(30.6)	58 (13.4)	0.005	3 (23.1)	15 (7.5)	0.084
Health will limit ability to work	50 (64.9)	495(51.2)	0.020	16 (64.0)	9 (36.0)	0.016

*Post-bronchodilator FEV_1 <80% predicted and FEV_1/FVC ratio <0.7.

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S4 OCCUPATIONAL ASTHMA; IS THIS THE CAUSE OF EXCESS RESPIRATORY SYMPTOMS AND COPD DESCRIBED IN BITUMEN EXPOSED WORKERS?

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Introduction Epidemiological studies suggest increased risk of asthma and COPD in asphalt exposed workers.[1] Bitumen is used in this industry. In this case we describe occupational asthma caused by bitumen exposure in a lab environment. This is the first such report to our knowledge.

Case History A 49-year old male with no history of asthma or atopy and <5 pack years smoking history presented with airflow obstruction on surveillance spirometry, cough and wheeze. He analysed hot bitumen samples (1900 C) in a lab environment without using respiratory protective equipment. Spirometry FEV_1 57%, FVC 85% ratio 55%. Respiratory symptoms improved after 3 weeks off work, returning soon after he rejoined the lab. Peak flow rates were variable and lower at work. Analysis with OASYS scored 3.08 (Abstract S4 figure 1). Histamine challenge test was positive (PC_{20} 2.216 mg/ml). Skin prick test to paraldehyde was positive. After 8 weeks away from the exposed environment the subject was asymptomatic, continued to have obstructive spirometry but improved bronchial reactivity (PC_{20} 7.489 mg/ml) without medication and improved peak flows with little diurnal variation. One week after restarting work the respiratory symptoms returned. Repeat OASYS charts scored 3.14 with histamine reactivity similar to baseline (PC_{20} 2.81 mg/ml) after 4 weeks. A specific challenge test was not possible due to the problems with heating bitumen to 1900°C in the hospital lab.

Conclusion The progression of symptoms and lung function in relation to work history supports the diagnosis of occupational asthma induced by bitumen fume exposure. This has not been reported previously. The possible mechanisms include sensitisation to short chain aldehydes, produced by partial combustion of

bitumen which oxidises at these temperatures. Other potential sensitisers contained in bitumen are nickel and vanadium. Further studies are needed to investigate the by-products of heated bitumen and whether the previously described excess of COPD and respiratory disease in these workers is due to unidentified occupational asthma from bitumen fume exposure.

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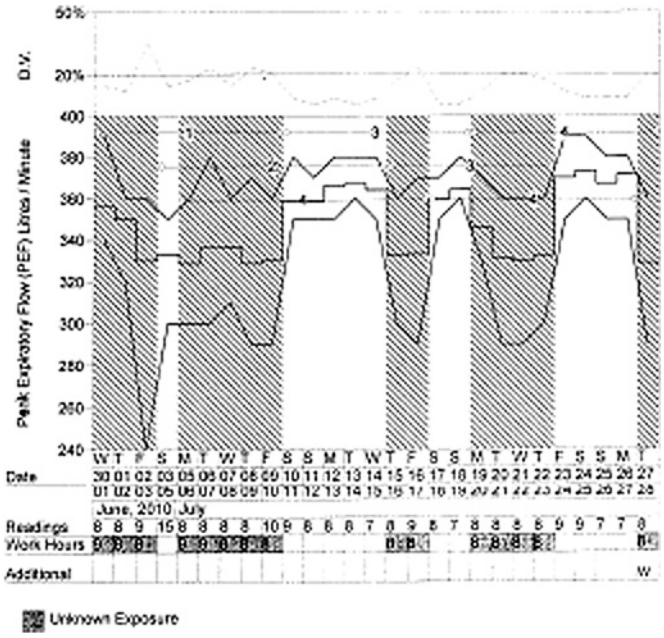

Abstract S4 Figure 1

S5 THE PREVALENCE OF ASTHMA AMONG CLEANERS IN THE UK

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Background A number of epidemiological studies have shown a significant association between asthma and working as cleaner but reporting schemes and workforce surveys have identified typical features of occupational asthma in only a small minority. This discrepancy is either due to under-reporting; misattribution of work-exacerbated asthma, or development of occupational asthma with atypical symptoms that make it difficult to diagnose clinically.

Aim To determine the prevalence of asthma in a cohort of hospital and university cleaners in the UK.

Methods A respiratory symptom questionnaire was distributed to cleaners via their supervisors in 3 local hospital trusts and 2 universities.

Results 570 of an estimated 1400 cleaners (41%) returned the questionnaire but it is uncertain how many received it and so the true response rate is uncertain. Respiratory symptoms were common. 48% (272/570) of the cleaners reported at least one: 34% reported wheezing, 35% reported cough, 10% reported breathlessness and 11 % reported chest tightness. Night-time or early morning symptoms suggestive of asthma were reported by 35 % of the cleaners. 12% reported symptoms only following exposure to chemicals used at work. 14% of the cleaners reported physician-diagnosed asthma. In 30% asthma developed after they started work as a cleaner with a mean interval of 8 years. An additional 3% had taken asthma medication in the last 12 months without a clinical diagnosis of asthma.

Conclusion This study has identified a high prevalence of asthma among cleaners in the UK and a substantial proportion that developed it after first exposure to cleaning agents. Symptoms on exposure to cleaning agents were also common. Further investigation of the risk factors for asthma and the work-relatedness of the symptoms of asthmatic cleaners are planned.

S6 SUPERMARKET BAKERS ASTHMA: A REPORT OF THREE SUCCESSIVE ROUNDS OF SURVEILLANCE

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In 2006, we set up a surveillance programme with a large UK supermarket employing almost 4000 "scratch" bakers (who mix dough and bake bread from scratch using raw ingredients) in around 350 stores. We report here the analysis of the programme through to 2010. The company occupational health provider screened all bakery workers for respiratory symptoms every other year, using a initial questionnaire (Level 1), with positive responders completing a subsequent, more detailed telephone-administered questionnaire (Level 2). Those who reported work-related nasal or respiratory symptoms were asked to provide a serum sample for specific IgE to bakery antigens. Those with positive specific IgE to flour or α-amylase (>0.35 kU/l) were directly referred for a specialist opinion. Abstract S6 table 1 shows the results of three surveillance rounds in 2006, 2008 and 2010. The frequency of work-related symptoms, sensitisation and disease across the three rounds of surveillance were remarkably constant. Measured prevalence is low (0.3—2 in 1000 bakers) although this figure is likely to be an underestimate; a previous study in the same workforce has demonstrated a reluctance to report symptoms and incomplete response rates.[1] This system of surveillance is efficient but has thus far not been effective in reducing the incidence of occupational allergy.

Abstract S6 Table 1 Results of three bakery worker respiratory surveillance rounds 2006—2010

Year	Level 1 questionnaires sent	Level 2 questionnaire completed (n,%)	Serum samples requested (n,%)	Serum samples received (n)*	Positive specific IgE to either flour or α-amylase (n,%)	Workers with positive IgE and symptoms seen in clinic (n,%)	Occupational asthma (n, %)	Occupational rhinitis (n,%)	Disease Prevalence (OA +/or OR, % of original Level 1 population)
2006	3780	571 (15%)	89 (16%)	84	16 (19%)	16	4	7	0.2
2008	3243	423 (13%)	66 (16%)	66	5 (8%)	5	1	1	0.03
2010	3833	626 (16%)	80 (13%)	89*	14 (16%)	14	5	4	0.2

Total numbers of employees completing each round with proportions, expressed as percentages of previous surveillance step, are shown where appropriate. Disease prevalence is expressed as a percentage of the baseline population.
*Samples received through occupational health include those from subjects declaring symptoms between surveillance rounds, hence number can be greater than samples requested during routine surveillance.