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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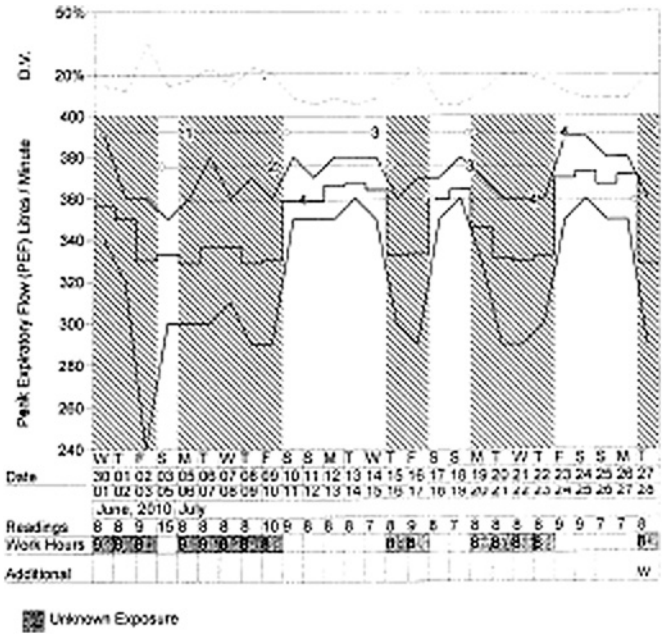

Abstract S4 Figure 1

S5 THE PREVALENCE OF ASTHMA AMONG CLEANERS IN THE UK

doi:10.1136/thoraxjnl-2011-201054b.5

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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

doi:10.1136/thoraxjnl-2011-201054b.6

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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.

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Clinical studies in asthma

S7 ADIPOSITY AND ASTHMA, PULMONARY FUNCTION AND ATOPY IN 11-YEAR OLD CHILDREN: A BIRTH COHORT STUDY

doi:10.1136/thoraxjnl-2011-201054b.7

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Background Results of studies investigating the association between obesity and asthma, atopy and lung function have been inconsistent, in part due to the limitation of BMI in evaluating body adiposity.
Objectives To investigate the association between obesity and asthma, wheeze, atopy, lung function and bronchial hyper-responsiveness in children at age 11 years using bioelectrical impedance (BIA) and BMI.
Methods Children from the unselected birth cohort study attending follow-up at age 11 years had percent body fat (PBF) and truncal fat (PTF) assessed using BIA (Tanita BC-418). Weight and height were also measured. Current asthma and wheeze were derived from a validated respiratory questionnaire. Atopy was ascertained using skin prick testing. Lung function was assessed using spirometry and bronchial hyper-responsiveness by 5-step methacholine challenge according to ATS guidelines.
Results 646 children (339 male) completed anthropometric measurements. BMI z-score, PBF and PTF were associated with current wheeze (OR [95% CI]: 1.27 [1.03 to 1.57], p=0.03; 1.04 [1.00, 1.08], p=0.04; 1.04 [1.00, 1.08], p=0.04 respectively). BMI z-score, PBF and PTF were also associated with current asthma (1.30 [1.04 to 1.63], p=0.02; 1.04 [1.00 to 1.08], p=0.06; 1.04 [1.00 to 1.08], p=0.04). However, the effect of PBF and PTF appeared strongest in girls (PBF: 1.12 [1.04 to 1.20], p=0.004; PFT: 1.11[1.04 to 1.20], p=0.003; p=0.05 and p=0.04 for interactions respectively). Children were defined as normal or overweight according to BMI (23% overweight) and PBF (29.8% overweight) cut-offs; overweight children had an increased risk of asthma (BMI: 1.73 [0.99 to 3.02], p=0.05; PBF: 2.09 [1.23 to 3.32] p=0.006). This was highly significant in girls (BMI: 3.34 [1.43 to 7.83], p=0.005; PBF: 4.74 [1.98 to 11.35], p<0.001; p=0.05 and p=0.02 for interactions respectively). Increasing BMI was associated with increases in both FEV_1 and FVC but reductions in FEV_1: FVC ratios. This association was again stronger in girls than boys. No associations between adiposity and atopy or bronchial hyper-responsiveness were found.
Conclusion Higher BMI z-score, PBF and PTF were associated with increased risks of wheeze and asthma. This effect was stronger in girls. BIA measurements appeared to have stronger associations in girls with outcomes than BMI. This may reflect the ability of BIA to measure adiposity more accurately than BMI.

S8 SENSITIVITY OF IMPULSE OSCILLOMETRY AND SPIROMETRY IN THE ASSESSMENT OF BETA-BLOCKER INDUCED BRONCHOCONSTRICTION AND BETA-AGONIST BRONCHODILATATION IN MILD-TO-MODERATE ASTHMATICS

doi:10.1136/thoraxjnl-2011-201054b.8

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Introduction and Objectives Impulse oscillometry (IOS) is known to be a sensitive marker of airway dysfunction, but is commonly associated with a wider variation than spirometry. The effects of β-blocker induced bronchoconstriction on IOS have not been studied. We compared the sensitivities of IOS and spirometry in the assessment of bronchoconstriction to propranolol and bronchodilatation to salbutamol.
Methods Mild-to-moderate persistent stable asthmatics taking =1000 μg day budesonide or equivalent, received a single dose of 10 mg or 20 mg of oral propranolol followed by histamine bronchial challenge testing (PC10), with recovery to nebulised salbutamol (5 mg). Spirometry and IOS were measured pre and 2-h post β-blocker, post histamine and 20 min post salbutamol. Pre vs post % change (95% CI) values were compared and standardised response means (SRM) were calculated to assess the "signal to noise" of each test.
Results Thirteen patients (mean age, 34 years) completed per protocol: 11 received 20 mg of oral propranolol. All IOS indices showed a greater magnitude of response to propranolol (ie, as % change) compared to spirometry. After adjustment for test variability, in response to propranolol, SRM's for IOS outcomes were better than spirometry with the highest seen with R5 and *f*res. Likewise for the bronchodilator response to salbutamol the highest SRMs were also seen with R5 and *f*res (see Abstract S8 table 1).
Conclusions IOS is a more sensitive response outcome than spirometry with respect to bronchoconstriction to oral propranolol and bronchodilatation post salbutamol in mild-to-moderate asthmatics.

S9 INHALED AND SYSTEMIC CORTICOSTEROID RESPONSE IN MODERATE-TO-SEVERE ASTHMA ASSESSED BY EXTENDED EXHALED NITRIC OXIDE AND LUNG FUNCTION

doi:10.1136/thoraxjnl-2011-201054b.9

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Introduction and Objectives Alveolar nitric oxide (CANO) has been proposed as a potential biomarker of small airway inflammation in

Abstract S8 Table 1

	Bronchoconstriction		Bronchodilatation	
Outcome	**Mean % change (95% CI), p Value**	**Standardised response mean**	**Mean % change (95% CI), p Value**	**Standardised response mean**
Spirometry				
FEV_1 (l)	4.6% (1.9 to 7.3), p=0.009	0.86	31.5% (18.2 to 44.7), p<0.001	1.67
FEF_{25-75} (l)	6.2% (−0.2 to 12.6), p=0.116	0.47	57.9% (29.1 to 86.7), p<0.001	1.42
Impulse oscillometry				
R5 (Airway Resistance at 5 Hz) (kPa L/s) *(Total airway resistance)*	30.8% (14.01 to 47.6), p<0.001	1.32	45.8% (36.7 to 55), p<0.001	1.87
R5-20 (difference) *(Small airways resistance)*	104.1% (22.6 to 185.6), p=0.004	1.05	115.6% (55.6 to 175.7), p<0.001	1.43
AX (area) (Respiratory reactance)	118.5% (37.2 to 200), p=0.007	0.94	82.6% (73.9 to 91.3), p=0.001	1.26
*f*res (Resonant Frequency) (Hz)	39.4% (16.6 to 54.3), p=0.002	1.13	50.7% (40.7 to 60.8), p<0.001	2.13