107. Occupational asthma

P1015
Chemical exposure and lung function in the fragrance industry: A multi-site cross-sectional study
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Introduction: Exposure to fragrance ingredients and other chemicals is widespread in the fragrance industry. Aims and objectives: To assess the exposure to fragrance components and other relevant chemicals in the fragrance industry, and to evaluate their potential impact on respiratory health. Methods: A cross-sectional study was conducted in 10 fragrance companies in Spain. A total of 100 workers were recruited, and their exposure to fragrance ingredients and other chemicals was assessed by personal sampling and questionnaire. Results: The most frequently detected fragrance ingredients were benzyl salicylate, benzyl benzoate, and linalool. There were significant variations in personal exposure levels among different companies. There was a significant association between exposure to benzyl salicylate and nasal symptoms. Conclusions: Exposure to fragrance ingredients in the fragrance industry can have a significant impact on respiratory health. Further studies are needed to evaluate the long-term effects of exposure to these chemicals on the health of workers.

P1016
Across-shift decrease in fractional exhaled nitric oxide among Tanzanian cement production workers
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Background: Nitric oxide (NO) is a respiratory marker used to evaluate the health status of workers. Aim: To investigate the across-shift decrease in fractional exhaled nitric oxide (FeNO) in cement production workers in Tanzania. Methods: A cross-sectional study was conducted in nine cement factories in Tanzania. A total of 300 workers were recruited, and their FeNO levels were measured at the beginning and end of their shift using a chemiluminescence analyzer. Results: The FeNO levels were significantly lower at the end of the shift compared to the beginning of the shift. There was a significant correlation between FeNO levels and the duration of shift. Conclusions: Exposure to dust and other respiratory hazards is associated with a decrease in FeNO levels in cement production workers. Further studies are needed to evaluate the long-term effects of exposure to these chemicals on the health of workers.

P1017
Causes of work-exacerbated asthma
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Rationale: A 2011 statement of the American Thoracic Society concluded that work-exacerbated asthma (WEA) is common in industrialized nations, with a prevalence of 21.5% in adults with asthma. While there are published lists of workplace agents that can cause occupational asthma, there are no comparable lists for WEA. We reviewed published articles to prepare such a list.

Methods: We systematically searched the peer-reviewed medical literature to identify articles about WEA published during 1980–2011. We selected articles that reported WEA agents identified case-by-case (from clinical case series, surveillance and worker compensation programs) or in risk-set analyses that used statistical models to determine occupational exposures associated with exacerbation of asthma or WEA.

Results: The literature search identified 13 articles that reported exposures for work-related exacerbation of asthma, including 3 risk-set studies. The studies were conducted in several countries in North America and Europe, and used various criteria for WEA and methods to determine exposures. From studies with WEA identified on a case-by-case basis, the more common types of agents included miscellaneous chemicals, dust, paint, smoke, indoor air quality, and cleaning products. From two risk-set studies conducted in general population settings, exposures with statistically significant (p <= 0.05) relative risks of 2.0 or greater included dust, exposure to gas and fumes, indoor air quality, physically strenuous work, and probable daily occupational exposure to dust, gases, or fumes.

Conclusions: Various types of workplace exposures can exacerbate asthma, including irritants, agents with sensitizing traits, and physical factors such as strenuous exercise.
Pulmonary inflammation and levels of immunoregulatory cytokines were determined in BAL. Total serum IgE was measured in blood. The analyses were made on days 2, 4 and 7 after induction of asthma.

Results: Animals sensitized to persulfate salts showed an increase in bronchial hyperresponsiveness to methacholine and in the % of neutrophils and total IgE after inhalation of persulfate salts, compared with the control group. The animals treated with mesenchymal stem cells showed a decrease of the bronchial hyperresponsiveness to methacholine and the percentage of neutrophils and total IgE compared to the control group S. There were significant differences between groups MSC and ST2 in the levels of IgG, IL-13 and IL-6 that were lower in the ST2 group on day 4 after induction of asthma.

Conclusions: In the described model of OA mesenchymal stem cells modified to secrete ST2 have shown anti-inflammatory capacity and attenuation of bronchial hyperresponsiveness.

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P1020 Serial PEF measurements detect occupational alveolitis and occupational asthma due to metal-working fluid
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Introduction: Serial measurements of Peak Expiratory Flow (PEF) are the most appropriate and available method for confirming occupational asthma. Changes in PEF may also occur in alveolitis.

Aims: To compare work-related changes in PEF between workers with allergic alveolitis and occupational asthma with exposure to the same metal-working fluid aerosols.

Methods: Symptomatic workers from rest day improvement from an engineering factory were asked to measure PEF 8 times daily for 4 weeks at home and at work before remedial action in the workplace. Allergic alveolitis was diagnosed by an expert panel from combinations of systemic symptoms with breathlessness, audible crackles in the lungs, CXR or CT scan showing compatible interstitial changes and reduced DLCO. Occupational asthma was diagnosed from work-related wheeze or breathlessness and confirmed with physiological tests including serial PEF measurements. The Oasys PEF plotter was used to calculate differences between rest and workdays for mean PEF, diurnal variation and the scores used to confirm occupational asthma (Oasys, ABC and timepoint).

Results:

<table>
<thead>
<tr>
<th>Study 1</th>
<th>Study 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Difference in PEF (rest-workdays) (litrres/min) (SD)</td>
<td>22.5 (30.8)</td>
</tr>
<tr>
<td>Mean diurnal variation on workdays (% mean) (SD)</td>
<td>14.9 (7.7)</td>
</tr>
<tr>
<td>Mean diurnal variation on restdays (% mean) (SD)</td>
<td>9.7 (6.9)</td>
</tr>
<tr>
<td>% with mean workday diurnal variation &gt;20% predicted</td>
<td>20</td>
</tr>
<tr>
<td>ABC score &gt;2.5 (%)</td>
<td>73</td>
</tr>
<tr>
<td>Oasys score &gt;2.5 (%)</td>
<td>73</td>
</tr>
<tr>
<td>Positive timepoint analysis (%)</td>
<td>66.7</td>
</tr>
</tbody>
</table>

Conclusions: Changes in serial PEF measurements are similar in workers with occupational allergic alveolitis and occupational asthma.

P1021 Decrease in respiratory symptoms in the Danish furniture industry is associated to a decline in wood dust exposure – Results from two cross sectional studies 5 years apart
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Objective: To investigate associations between wood dust exp. and resp. symptoms in two studies 5 years apart from the same area.

Methods: 2,032 woodworkers from 54 plants in study 1 and 1,889 woodworkers from 52 plants in study 2 returned a questionnaire on resp. symptoms, employment and smoking habits. Assessment of wood dust exp. was based on job exposure matrices including factory size, task and personal dust measurements (2,217 in study 1 and 1,355 in study 2).

Results: The median (range) of inhhalable dust conc. was 0.8 (0.4-1.6)mg/m3 in study 1 and 0.6 (0.3-1.1)mg/m3 in study 2. The prev. of selfrep. asthma was higher, but the prev. of resp. symptoms were lower in study 2 vs. study 1. In adj. logistic regression analyses wood dust exposure explained the difference in symptom prevalence between study 1 and study 2, but no effect was found for selfrep. asthma. No influence of sex, smoking and age was seen.

P1022 Irritative respiratory symptoms and ventilatory function to workers exposed to man made mineral fibres
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We conducted a case-control study of 43 subjects who use Man Made Mineral Fibres (MMMF) to isolate cookers: 25 male and 18 female, aged 29-55, average of exposure 17.7±4.1 years and a matched control group. Clinical, respiratory, skin and eye symptoms were recorded by questionnaire, pulmonary functional tests (PFT); MMMF mean concentration in the workplace air was measured. Prevalence of chronic respiratory symptoms in exposed workers was significantly higher (32% vs. 21%).

We found that irritative symptoms of the upper airways in exposed workers were significantly associated with duration of exposure (r=0.57, p<0.005). A significant correlation between symptoms and PFT values was found in workers having more than 10 years exposure. Values of FVC, FEV1, FEV1/FVC and small airways indices in exposed workers were significantly lower (r=0.42, p<0.01). Small airways changes in exposed workers were strongly linked to duration of exposure (r=0.37, p<0.05) whereas relation of cutaneous symptoms and professional age was not significantly linked. We found that irritative ocular or tegumentary syndrome was more frequently revealed at the exposed subjects, especially in the first 10 years of activity. Our data suggest interactive influence of workplace exposure to MMMF in development of irritative anomalies of the upper airways with predominantly smaller airways affecting.

P1023 Blood oxidative markers in glass industry workers and related respiratory outcomes
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Aim: Workers from a glass factory were investigated by a longitudinal study to detect respiratory outcomes and their relations with working conditions. Material/Methods: 229 nonsmoker workers (40% men) with mean age 35±9 yrs and mean exposure in glass industry 14±9 yrs were examined by clinical, spirometric and biochemical tests. Blood superoxide dismutase (SOD), glutathione peroxidase (GSHPx) and serum lipoperoxidase (LP) were assayed as effect markers. Occupational risk was estimated by workplace air contaminants (WAC), Pb in blood, urine (U-Pb), and by urinary delta-aminolevulinic acid (ALA).

Results: Although WAC (inorganic Pb, acetone, toluene, white spirit, varnishes) were measured in blood, urine (U-Pb), and by urinary delta-aminolevulinic acid (ALA).

Conclusions: No influence of sex, smoking and age was seen.

Figure 1. Change in OR for study 1 vs. study 2, unadjusted and adjusted for wood dust exposure.

Conclusion: An association between respiratory symptoms and wood dust exposure was confirmed.
P1024
Absence of non-specific bronchial responsiveness (NSBR) in occupational asthma (OA): A case-series study
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Background: Although increased NSBR is a key component of OA it may be absent in rare occasions as previously shown.

Objective: Describe the prevalence of confirmed OA with normal NSBR before and after specific inhalation challenge (SIC).

Methods: We retrospectively reviewed our database containing all SIC done in our laboratory or at work between 1997 and 2011. OA was defined by a positive SIC with a >25% sustained decrease in FEV1; normal NSBR was defined by a mean SD delay between cessation of exposure and work and SIC was >92.6±8.17 hours. However, 10 subjects had at least one PC20M<16 mg/ml.

Results: 373/1193 workers tested had confirmed OA. 22/375 (5.9%) had normal NSBR before and after SIC. The mean±SD delay between cessation of exposure at work and SIC was 96.2±8.17 hours. However, 10 subjects had at least one PC20M<16 mg/ml during their investigation while symptomatic and at work for 9 of them. The remaining 12 had normal NSBR on all tests but only 3 subjects had such a test while at work (2 while symptomatic). Among the 22 cases, 20 were atopic, 15 were exposed to a high molecular weight agent, 4 to a low molecular weight chemical and 3 to various agents during workplace challenge. Seventeen, 4 and 1 subjects had an early, late and atypical asthmatic reaction respectively. However, even if NSBR was always within the normal range, 3 subjects had a significant drop in PC20M (~3.2 fold) post-SIC and 13/14 showed an increase in spumation eosinophils count after SIC (mean increase of 9.9±6.7%).

Conclusions: We describe 22 cases of confirmed OA despite normal NSBR before and after SIC. This is however rare (5.9% of confirmed cases of OA by SIC). In our experience, it is exceptional to have normal NSBR symptomatic and at work in cases of confirmed OA.

P1025
Does FENO predict FEV1 response to exposure cessation in occupational asthma?
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Introduction: The prognosis in workers with occupational asthma following cessation of exposure is very variable. We investigated whether FENO measured while exposed and after removal of exposure is very variable. We investigated whether FENO measured while exposed and after removal of exposure.

Methods: 68 workers had FAEV1 calculated from linear regression of individual lung function measurements for a total of 5 years after the plant closed. FENO was measured while exposed and after removal.

Results: See Table 1.

<table>
<thead>
<tr>
<th>FENO &lt;24 ppb</th>
<th>FENO &gt;24 ppb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>36</td>
</tr>
<tr>
<td>FAEV1</td>
<td>36.8 ml/yr</td>
</tr>
<tr>
<td>Mean FENO while exposed (SD)</td>
<td>15.2 (5.2) ppb</td>
</tr>
<tr>
<td>Mean FENO post exposure (SD)</td>
<td>17.9 (7.2) ppb</td>
</tr>
<tr>
<td>Baseline FEV1 % predicted (SD)</td>
<td>92.3 (15.6)</td>
</tr>
<tr>
<td>NSBR %</td>
<td>63</td>
</tr>
<tr>
<td>Current smokers %</td>
<td>36</td>
</tr>
<tr>
<td>Age %</td>
<td>36</td>
</tr>
<tr>
<td>Never on ICS %</td>
<td>45</td>
</tr>
<tr>
<td>Latent period in years (SD)</td>
<td>11.6 (6.7)</td>
</tr>
</tbody>
</table>

Conclusion: Workers with normal FENO at presentation appeared to have increased ΔFEV1 compared to those with FENO raised levels. The differences were not statistically significant and needs investigation in larger worker groups.

P1026
Increased exhaled nitric oxide among workers exposed to metalworking fluid aerosol
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Background: Recent outbreaks of respiratory symptoms among workers, including dry cough, asthma symptoms and pneumonitis, exposed to metal working fluids (MWF). This study aimed to investigate if exposure was associated with increased exhaled nitric oxide (FENO).

Methods: A group of 16 exposed workers, in whom personal exposure measurements were performed, were examined with FENO directly after summer vacation and after a working period of at least 6 continues days. Subjects with upper respiratory tract infection within three weeks were excluded, as well as smokers and snuffers. FENO was measured with NIOX MINO9.

Results: FENO increased in 13 out of 16 subjects, the median FENO directly after holidays was 14 ppb and 16.5 ppb after the working period. The increase was higher among those who had an initial higher FENO value. The mean increase of FENO was 38% (95% CI 16-60%) analyzed with a paired t-test.

Conclusions: FENO increased substantially after exposure to MWF in most subjects. Repeated measurements of FENO in workers seem to be a relevant method to identify subjects with airway inflammation after exposure to MWF. When more subjects have been included in the study, FENO may also help to sort out what characteristics of the exposure can be associated with airway inflammation.

P1027
Respiratory symptoms and lung function tests among the goldsmith engaged in jewellery manufacturing industries in India
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Introduction: The goldsmiths are exposed to various acidic and metallic fumes at work. But no study has been reported on goldsmiths neither on the Indian jewellery industries evaluating the relationship between occupational exposure and respiratory health.

Methods: We studied the spread of respiratory symptoms and lung function tests among goldsmiths engaged in Indian jewellery manufacturing industries. We recruited a total of 134 males participated in the study among which 100 were the industry workers (mean age 34±4.2 years) and 34 were front desk office executives (mean age 37±4.2) of the same industry. Evaluation of examined subjects included com- position of a standardized questionnaire on respiratory symptoms and spirometry. Data were analyzed using odds ratio with 95% confidence interval and logistic regression adjusting for age, smoking status, second hand smoke exposure and parental atopy/asthma.

Results: The goldsmiths had significantly higher prevalence of chronic cough (OR = 3.5, 95% CI = 1.2-8.2), nasal allergy (OR = 2.9, 95% CI = 1.1-4.8), production of phlegm (OR = 3.2, 95% CI = 1.4-6.2) and tightness in chest (OR = 2.7, 95% CI = 1.7-4.7) compared to the office workers. Results indicated a significantly lower percent predicted values of FVC (p<0.05), FEVI (p<0.001), FEVI/FVC (p<0.01) and FE25-75 (<0.001).

Conclusions: Due to exposure to various sensitizers and irritants (metallic and acidic fumes) in the workplace the goldsmiths had greater prevalence of respiratory disturbances and a reduced lung functions compared to the front office staffs.

P1028
Case control study to assess the prevalence of obstructive airway disease in flour mill workers
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In India, the grain flour required for household cooking is made by grinding grains in machine operated flour mills, which are usually small sized unventilated rooms. These machines are operated by a single unskilled worker who works in shift duties of 6 hours. During operation, the machine generates large amount of flour or grain dust and produces clouds of flour that surrounds the worker thus predisposing him to obstructive airway disease. 46 flour mills in the city were visited. Customers of the mills with short exposure to flour dust served as controls who were matched for age and sex. Those with active lung infection or smoking tobacco smokers were excluded from both groups. On site measurement of PEFR was done, using Mini Wright’s peak flow meter for a total of 44 workers and 44 controls. The intention of using a peak flow meter instead of spirometry was to evaluate usefulness of this simple modality which can be easily applied in villages where flour mills are more common and spirometry is not available. The
peak flow readings between >100%, 80-99%, 50-79% and <50% predicted value were labelled as normal, green, yellow and red zone respectively. 22/44 workers had normal PEFR as against 38/44 controls. 19 and 3 workers were in green and yellow zone respectively whereas 6/44 controls were in green zone. P1027 workers using a face mask had normal PEFR as against only 3/17 not using the mask (P=0.0001). Only 1/46 mills had enclosed machine with dust filter and the worker was in green zone even after 15 years of work duration. The study indicates a potential occupational hazard to the flour mill workers. Use of face mask or enclosure of machine can potentially reduce the risk.

Background: The most common occupational lung disease reported in industrial countries is occupational asthma. There are limited data about the prevalence of work-related asthma among asthmatics in Iran.

Objectives: The aim of this study was to assess prevalence of work-related respiratory symptoms (WRS) and occupational exposures in asthmatic adults at pulmonary clinics.

Material and methods: A cross sectional study was performed. All ≥17 year old asthmatics were recruited into the study. A questionnaire mainly based on one developed by NIOSH was completed by each participant. Currently employed subjects were subdivided into two groups by WRS status. Subjects’ occupation and workplace exposures were evaluated using an asthma specific job exposure matrix (JEM). Statistical analyses were conducted using the Student’s Ttest for continuous data and Chi square for categorical data. Prevalence ratios (PRs) were calculated, using a Cox regression model.

Results: 39 (21.8%) of 179 current employed asthmatics (11% of all 339 adult asthmatics) had WRS. Subjects with WRS were more likely to have self-reported allergy (PR:2.7 Pvalue:0.003) and low molecular weight antigens’ exposure (PR:2.7 Pvalue: 0.0001). According to the JEM, those with WRS had more high risk occupational exposures (PR: 2.2 Pvalue:0.003). The two most frequent occupational classes for asthmatics with WRS were trades, transport and equipment operators (33%), and processing, manufacturing and utilities (31%).

Conclusion: Prevalence of WRS in the current study is consistent with previous reports of work- attributed asthma. Study results emphasize further need for taking complete occupational histories in adult asthmatics.

P1030 Effects of exposure to flour dust on respiratory symptoms and pulmonary function of mill workers
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Background: Exposure to flour dust is associated with development of respiratory symptoms and varying degree of reduction in lung function. The aim of the study was to assess the effect of Exposure to flour dust on respiratory symptoms and pulmonary function of mill workers. The study was undertaken at Sohag flour mills.

Methods: A study was conducted at flour mills in Sohag Governorate. Two hundred and six male workers with current exposure to flour dust and two hundred non-exposed male as a control group were interviewed. Pilot study was done using self designed study questionnaire and the questionnaires were administered to them and the parameters of their pulmonary function were measured.

Results: Respiratory symptoms such as cough, expectoration, wheezing, and shortness of breath, were significantly (p<0.001) more common in exposed workers as compared to unexposed counterparts. Furthermore significant (p<0.001) decrements in the pulmonary function of exposed subjects were noted. The additive effect of smoking was clearly noticed as there was a highly statistically significant increase in FEV1% and FVC% and PFT values. Smoking, COPD, asthma and chronic bronchitis were significantly (p<0.001) higher among workers compared with control subjects. Statistically significant association between COPD, asthma, chronic bronchitis and age (p<0.02), smoking (p<0.002), duration of employment (p<0.003), level of exposures (p<0.001) was found.

Conclusions: Flour mill workers were at an increased risk of developing pulmonary symptoms & a strong association exists between exposure to flour dust and the prevalence of respiratory symptoms and functional impairments of the lungs.